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PROCEDURE AND TECHNIQUES  
FOR TREE AND SHRUB PLANTING

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THIS BULLETIN WILL BE MAINTAINED IN  
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VELOPMENTS AND IMPROVED KNOWLEDGE

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## A. INTRODUCTION

In this bulletin an attempt has been made to present in brief understandable form, procedures and techniques applying to tree and shrub planting. One should consider that this bulletin is the initial attempt of an effort to attain reasonable and practical field uniformity. The continued assistance of field personnel is solicited toward the improvement of this statement in order that with additional experience more authoritative material can be presented for guidance.

## B. PROCUREMENT OF PLANTING MATERIALS

Ordinarily the first step in carrying out a planting plan after its preparation and approval is the procurement of planting materials. Planting stock requirements must be given consideration long before the plantings are made since it takes considerable time to grow planting stock. There are four ways in which planting materials may be obtained:

- Regional nursery
- Local collection
- Commercial and state extension nursery
- Home-grown

### 1. From the Regional Nursery.

A great majority of the planting material used in carrying out planting plans will be requisitioned and obtained from Service Nurseries. This material must be requisitioned sufficiently in advance of the date needed to allow the nursery to produce it. Directions for reporting requirements for nursery stock are given in Regional Memorandum No. 125, which project and field men should use as a guide in preparation and submission of their needs.

In addition to reports called for in Regional Memorandum No. 125 a stock requirement report is due on September 1, as outlined in a memorandum issued September 2, 1938, pertaining to reporting requirements for planting stock.

### 2. Local Collection.

Occasionally it will be possible and desirable to collect planting materials locally, especially cuttings. In fact, cuttings of the larger size should be made as close to the point of use as is practical to reduce transportation costs. Activities relating to collection of wilding stock and of seed by personnel of the Woodland Management Section will be limited in amount, but will sometimes occur where favorable collection areas are located in the vicinity of the planting site. Collection of seed of native species and procurement of small quantities of more common species for experimental plantings or for production of planting stock in the locality where it is to be used, is highly recommended.



## Cuttings.

In a majority of cases cuttings may be made in the field in reasonable proximity to the area where needed at low cost. Where the Nursery Section can deliver them more cheaply it will be requested to do so.

## Size Classification.

For convenience in preparing plans and reports and map making, cuttings may be grouped in four size classes. This classification, which is optional, follows:

- A - 1 to 2 ft. long - to 1 in. top diameter
- B - 2 to 3 ft. long - to 2 in. top diameter
- C - 3 to 4 ft. long -  $1\frac{1}{2}$  to  $3\frac{1}{2}$  in. top diameter
- D - Over 4 ft. long - Over 3 in. top diameter

Classes are based on length; diameters are presented merely as a guide.

## Harvesting.

Harvesting of cuttings should be done during the late fall or early winter, shortly after the plants become dormant, and then stored for the winter so they will not be subject to freezing. In case this cannot be done, willow and cottonwood cuttings may be made in the spring before they leaf out. Cuttings procured in the spring should be planted immediately. Post size cuttings should be secured just before planting. If possible, cuttings should be made during rather mild, instead of severe, fall or winter weather as this permits making cleaner cuts and prevents excessive drying.

Two-year-old, or the largest and strongest one-year-old, stems should be selected for use if Class A cuttings are required. All cuttings should be at least 12 inches long and one-half inch in diameter, although cuttings of Class A size should average 18 inches long. Actual cutting should be done with a sharp knife and care should be used to make clean cuts. Cuttings of the larger sizes, as post cuttings, may be sharpened at the base to permit easier planting. Small cuttings to be stored should be tied in bundles of 50 or 100.

## Storage.

Cuttings to be stored over winter should be buried in moist moss, peat, sawdust, sand, or a mixture of these, on the floor of a storage cellar or some similar place where they will not freeze. Storage temperature should normally be about 35° F., though higher temperatures of about 55° F. for the first few days have been shown to facilitate callus formation.





## Wildings.

Wilding stock may be collected if particularly favorable collection sites are found, or if species or ages not available from the nurseries are desired. In general wilding stock is not so uniform or vigorous as nursery stock and unless good wilding material can be obtained at a lower cost, nursery stock is to be preferred. Technicians should proceed cautiously in the removal or destruction of vegetation in any area due to possible adverse criticism. On the other hand, this should not be interpreted as meaning that wildings should never be used; it is merely a warning against ill-advised collection.

## Harvesting and Storage.

Harvesting of wildings should be done in the early spring when the plants are in dormant condition, when the soil is not frozen and digging conditions are favorable, though it can be successfully done in the fall after the plants become dormant if they are properly stored over winter or planted immediately.

Wildings should be hand-dug with a spade or shovel and exposure of roots to air should be kept at the absolute minimum. Packing boxes filled with wet moss, sand, or sawdust should be available and all plants should as procured be carefully packed for transportation or heeled in. Especial care must be exercised in digging so that the delicate root systems will not be damaged.

Specific directions on storage will be given under the heading, "Care of Stock" in the section on "Planting Technique."

## Seed.

Collection of seed is normally a function of the Regional Nursery Section. Usually seed for field planting should be obtained from the nursery by requisition. Woodland personnel, however, should cooperate with the nurseries in collecting seed in out-of-the-way places visited, and procuring unusual species to be tested for practical use in soil conservation work. Each forester should practice carrying a small quantity of seed with him during the planting season in order that he may, where practical results appear possible, plant unused corners of fields, small denuded patches, and similar areas on lands under agreement. Such plantings will be experimental in nature. The forester may also establish plantings in garden tracts to furnish small quantities of stock which the cooperator may transplant, under SCS technical supervision, to proper places in the field as called for by planting plans.

Where seed is collected in cooperation with the Nursery Section, detailed instructions and specifications should be obtained from that Section. A few points to be kept in mind in all seed collection activities follow:



### Selection of Parent Stock.

Care should be exercised in selection of parent stock from which seed will be procured. This stock should be selected on the basis of size, form, health and other pertinent considerations. Caution should be used in selecting plants affected with disease which might be transmitted through or affect the viability of the seed. It will also be desirable to select parent stock growing under climatic and edaphic conditions similar to those to which the seedlings will be subjected. If seed is being collected for general use rather than for planting in some particular locality, seed plants which are growing under average site conditions for the species should be selected.

### 3. Commercial and Section 4 Clarke-McNary Nurseries.

In many cases, especially on farmlands, the terms of the cooperative agreement may call for procurement of planting stock by the cooperator. If so, the cooperator may obtain planting stock from commercial or Clarke-McNary Nurseries. The forester working on the area should check such material thoroughly to ascertain its condition on arrival and see that it has proper subsequent care.

The Soil Conservation Service may occasionally purchase stock from outside sources when unusual species not present in the nursery are desired.

### 4. Home-grown Stock.

Where stock is required for plantings which are desirable for best land use but not absolutely necessary in the control of erosion, and where plans are drawn up sufficiently in advance of actual field planting, it may be possible for the forester or for the cooperator to plant seed for production of planting stock. This method of cooperator production of planting stock should be encouraged as it arouses interest and leads to better land use. Such plantings will require careful tending by the cooperator. At the proper time home-grown stock may be field planted by this Service or by the cooperator, depending on the terms of the agreement.

## C. FIELD PLANTING

Plantings should be made only after adequate, approved plans have been prepared.

### 1. Planting Season.

The season for field planting of transplants and cuttings occurs from the time they are dormant in the fall until the leaves begin to appear in the spring. Planting should not be done when the ground is frozen. In the northern portion of the region freezing weather arrives





about the time the stock becomes dormant in the fall, so planting must be confined to the spring season. Winter planting can be carried on in the southern part of Arizona, New Mexico and Utah.

## 2. Organization.

A satisfactory planting program is dependent in large measure on its organizational effectiveness. Personnel should be sufficiently well trained to assure proper planning and planting work.

### Personnel.

Some past difficulty has been experienced in obtaining properly trained personnel to direct and supervise planting operations in the field. The following points are pertinent to a sound planting program.

Trained personnel are required to execute planting plans in an efficient and orderly manner. Such personnel should be made available as the job requires.

Personnel charged with the execution of planting plans will be technically responsible to the district or project forester.

Insofar as possible planting crews should remain intact throughout the planting season.

The size of the planting crew is dependent on several variable factors and should be decided by the forester in charge.

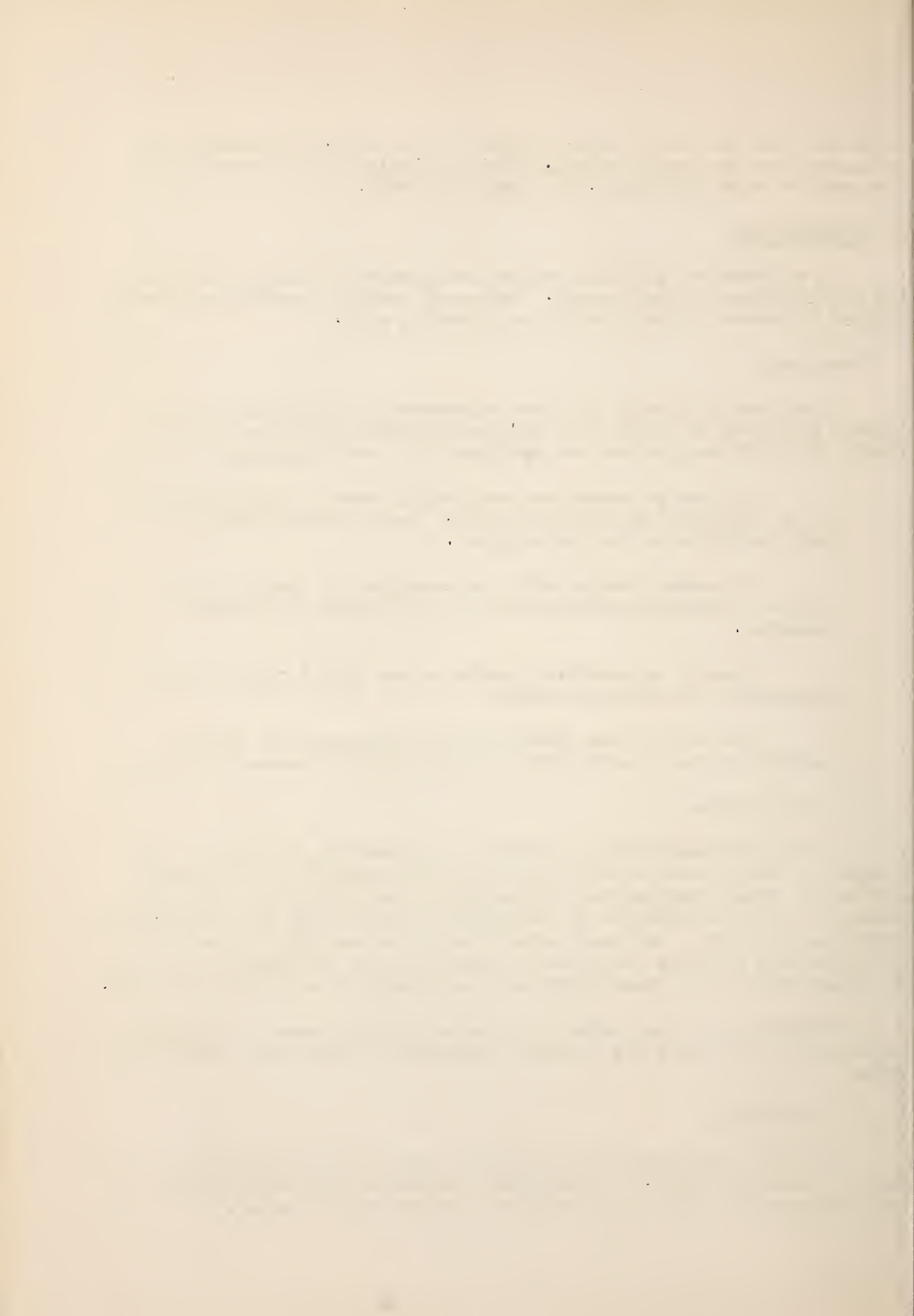
### Supervision.

Efficient supervision is the key to successful planting and the foreman in charge must be well trained by the technician and thoroughly capable of giving instructions and continuous supervision to crew members. He should be selected on the basis of reliability and conscientious attention to detail. The crew members should be carefully chosen for their planting ability. They must receive detailed instructions of duties and should have or be given sufficient background to do intelligent work.

Foresters in charge should not leave planting crews on their own until assured that they are properly organized and are doing satisfactory work.

### Inspection.

Planting inspection is an important part of the forester's job during the planting season. The suggested inspection form which appears on the following page will be of value in securing good planting. It serves



# PLANTING INSPECTION REPORT

Project or Camp \_\_\_\_\_ Date \_\_\_\_\_  
 Cooperator \_\_\_\_\_ Plan No. \_\_\_\_\_  
 Field No. \_\_\_\_\_ Foreman \_\_\_\_\_

	#	REMARKS
Transporting Stock		
Heeling in, Central		
Packing		
Wind Protection		
Heeling in, Planting area		
Soil Preparation		
Fire Breaks		
Fencing		
Planting		
Location of planting		
Use of proper tools		
Care of stock		
Spacing		
Variance of technique		
Does foreman have copy of plan on job?		
Production		
Crew Organization - Remarks		

# Satisfactory x                      Unsatisfactory o                      Not required -

	TALLY	TOTAL	REMARKS
A. Trees Well Planted			
B. Improperly Planted			
Planted too deep			
Planted too shallow			
Not properly tamped			
Roots curled			
Holes not filled			
Trash in holes			
Mechanical injury			
Others			
*Score % _____			

\* Test 100 Trees - Give Score      Number Planted Correctly  $\div$  100 = % Properly Planted

Inspector \_\_\_\_\_

Title \_\_\_\_\_





to remind the forester of the items to be inspected. A copy left with the foreman shows him his weaknesses. If the report is entirely favorable, it will tend to stimulate good work. A copy attached to the planting plan record (Woodland Form No. 1) may assist in accounting for abnormally high or low survival.

Constant and vigilant inspection is necessary to eliminate the following causes of failure:

- Heating of trees
- Delay in unpacking
- Improper heeling in after unpacking
- Allowing tree roots to become dry before planting. Conifers are almost sure to die if so treated
- Failure to tamp soil tightly around roots
- Too deep or too shallow planting
- Failure to cull trees too small or malformed to survive
- Failure to place a protecting mulch around the tree when there is danger of frost heaving
- Allowing dry soil to come in contact with the roots
- Allowing litter or other undecomposed organic matter to come in contact with the roots
- Allowing the roots to become crowded in too small a hole
- Mechanical injury resulting from careless planting

#### Training.

Each district or project shall conduct a training program for all personnel directing and supervising planting operations. Planting foremen will be responsible for training the labor crews. The forester on each district or project shall outline the training program for his respective district, giving consideration to the points previously noted and to the following:

- Care of planting stock
- Interpretation of planting plans
- Crew organization
- Planting techniques
- Preparation of records and reports
- Safety

The training program should be carried out just prior to the planting season. The employment of supervisory personnel should be made early enough to allow their attendance at training programs.

### 3. Planting Technique.

#### Planting Stock.



### Care of Stock.

The care of planting stock from the time it leaves the nursery until it is planted in the field is most important. Due to factors of climatic aridity encountered planting stock must be given more than ordinary care.

### Transportation.

The Nursery Section is responsible for the proper care and packing of nursery stock, seed, and other materials for shipment to insure that planting materials arrive in good condition. Because of varying conditions existing on district or project units, practices of handling planting stock in the field will be left largely to the judgment of the supervising forester.

Transportation of wilding stock from the place of collection to the planting site and the transportation of planting materials in the field will be done with sufficient care to insure the trees against heating, drying out, or mechanical injury.

### Treatment for Insects and Disease.

All treatment required to insure healthy stock at time of arrival in the field should have been carried out before shipment. The supervising forester, however, should check all incoming stock and should discard and return samples of all diseased or insect-infested shipments.

### Heeling In.

When the plants arrive from the nursery the roots should be moist and it is imperative that they remain so. They should be placed in the heeling-in bed the day of arrival or at the latest by the following day. The bed should be located in a protected area in light, well drained soil. Shade and free air circulation are desirable to retard bud swelling since plants which have already started to grow cannot be expected to give good results when planted. For best protection bundles should be broken and plants spread in a thin layer along the side of the trench. Each plant should be placed sufficiently deep that there is no bending of the main root and about half the stem is covered with soil. The beds should be well tamped and watered to eliminate air pockets and to assure that the roots are surrounded with moist soil. Each species should be heeled in separately and tagged.

There are several methods of preparing heeling-in beds, each with its particular advantages. Exact choice of method will be left to the forester in charge with the understanding that ample protection against root drying will be provided. In any case preparation of the bed must be accomplished before the plants are removed from the moist packing material in the truck so that actual exposure to the air will be kept at a minimum.





One of the best methods of heeling in is to prepare a trench about eighteen inches deep (or deeper for larger stock) with one side sloping about 45°. The trench should be dug along one end of the area and should be approximately as long as the width of the proposed bed. Plants are arranged along the sloping side of the trench noted previously and are covered with earth as specified. The soil is tamped gently to eliminate air pockets and a second layer of plants follows. The trench thus moves progressively and moist soil is always available to cover the plants. This system may be extended indefinitely within the heeling-in area and any number of plants may be handled.

An alternate method is to prepare in advance a pit 4 or 5 feet wide, 15 to 18 inches deep, and of sufficient length to hold the entire shipment of stock. One end of the pit should be sloped about 45°. The first layer of plants is arranged along this slope and earth thrown over it from the side. After light tamping additional layers are arranged and covered until the entire pit is filled. The bed must then be well watered. The final result is identical in either case.

The first method noted has the advantage that soil is moved only once and is less exposed to drying. Also only enough excavation need be done to hold the plants on hand. The second method has the advantage that the heeling-in job is completed more rapidly after the plants arrive on the area. The first method requires the use of less supplemental water and is recommended where water is scarce. It should be used for heeling in small quantities of stock that have been moved from the main bed to the locality where planting is to take place.

#### Cold Storage.

The field forester will not usually be concerned with cold storage of planting stock. Stock should arrive from the nursery at, or shortly before, the proper time for planting. If this is done careful heeling in in a protected place is all that is necessary.

However, there may occasionally be instances where nursery stock must be held over for some time before planting, or instances where it is desired to hold material for later planting beyond the end of the dormant period. When this happens, the stock should be kept in cold storage in a storage cellar. Nursery stock, cuttings or stratified seed may be kept safely in cold storage over winter and dormancy will hold until a later date in the spring than if the materials were heeled in.

For planting at higher elevations it is possible to hold stock for later planting by heeling it in near the snow until the planting site is ready.

#### Lining out.

Lining out is another normal activity of the nursery which will



be done only occasionally by foresters in the field. If it is found desirable or necessary to hold stock in the field over a complete growing season, this stock should be lined out in a temporary bed. Spacing within and between the rows should depend on the size and kind of stock. Normal root development should be allowed during the growing period before field planting occurs, and the rows should be far enough apart to provide for periodic cultivation and irrigation. Actual planting in the process of lining out stock should usually be done in plow or cultivator furrows. Lined-out stock should be irrigated immediately after planting, especially if the furrow method is used. Lining out may be done at a CCC camp or on the cooperator's land. Periodic cultivation and weeding will be required.

#### Ground Preparation and Other Treatment.

Before field planting occurs the area should be prepared by plowing or plowing and listing. This eliminates competing vegetation and reduces the drain on soil moisture. Where the site can be prepared during the preceding season without wind-erosion damage the resulting storage of additional moisture will be beneficial in bringing the trees through the first year. On private lands the cooperator should be required to treat planting sites in this manner.

Special treatment, as subsoiling, may be employed where beneficial results are expected to justify this additional cost. Mulching and fertilizing should not be done without approval of the Regional Forester unless the cooperator intends to do this work at his own expense.

Rodent control may be desirable, but should be done only on areas where investigation establishes a definite need and where costs of control can be justified. The possible effect of rodent damage should always be considered at the time planting plans are prepared to decide whether or not plantings are practicable.

Structural treatment to secure additional moisture or protect plantings will often prove beneficial at reasonable cost. Collection of run-off water may make it possible to establish plantings which will later maintain themselves on underground water, or permit the growth of windbreaks where they could not be otherwise maintained.

#### Planting Rules.

Successful planting of rooted stock is a matter of attention to a few simple but essential rules, namely:

a. Roots must be kept moist from the time the tree is dug until it is planted in moist soil. For transportation from the heeling-in pit to the planting area, trees should be packed in boxes. Heavy paper cartons will do. These must be lined with burlap and the tree roots packed in wet moss or sawdust. Burlap should be tied over the top to protect from wind and sun. A suggestion as to a type of planting box





suitable for carrying stock is presented in the Appendix. The trees should be watered during the day so the roots are kept continually moist.

b. Planters should not carry more trees than they can plant in a reasonable time and must keep the roots covered with water or thin mud in a pail or well wrapped in wet burlap and moss in planting bags or boxes. Trees allowed to dry out should not be planted. But one plant at a time should be removed from bucket or planting bag and only after the planting hole has been prepared.

c. Mattocks, shovels, or dibbles ordinarily will be used in making holes which should be sufficiently deep to accomodate roots without bending. The use of uniform sized stock will be found helpful.

d. Holes of uniform size should be dug and the dirt so placed that the planter in moving forward always has it in the proper location. Holes should be dug only as needed as they dry out if prepared too far in advance.

e. The tree should be held in a vertical position, roots straight, root collar about one-half to one inch below the surface, until the soil is packed around the roots. In dibble planting the trees should be pushed well down into the hole and elevated to the proper level in order to straighten the roots.

f. A limited amount of soil should be packed firmly around the roots of the plant. The balance of the hole should then be filled in and the soil packed. These two steps constitute good practice. Never fill the entire hole immediately and attempt to pack all the fill material at one time. If a dibble is used it should be driven into the soil about four inches from the plant and at an angle that approaches or cuts into the bottom of the hole; the handle should then be pulled toward the operator to close the bottom of the hole and pushed toward the tree to close the top of the hole; finally the planter should kick the wedge of loose soil with his heel and pack it into the newly formed hole. Trees should be so tight that they can be pulled out only with considerable effort. Soil should not be piled around the base of the plant. Care should be taken that the bark and roots are not mechanically injured.

g. Planting should be completed in as short a time as possible, after field conditions become satisfactory, so that the transplants will receive the benefit of the most favorable conditions.

h. Planting stock of uniform size should be used whenever possible, especially on areas prepared for planting by the land owner.

Throughout this discussion especial emphasis has been placed on keeping plant roots continually moist from the time they are removed from seed or transplant beds until they are finally planted in moist





soil. No plant which has been allowed to dry out at any stage of handling should be planted even though it may have been subsequently moistened.

Successful field planting requires little technical knowledge, but constant attention and skill in the application of the simple and essential rules noted above. Foremen and other supervisory personnel should be continually on the alert for procedural changes to eliminate lost motion and increase output of high quality work.

### Planting Methods.

#### Rooted Stock.

Methods employed in planting will be largely dependent upon: soil; slope of the planting area; available moisture; local climatic conditions; size, kind, and class of planting material to be used; and other factors. It follows that planting methods should be varied to fit conditions even within a single small planting area and that methods applicable to one locality may be of no value in another. Final selection of the method most suitable to any particular site must be left to the judgment of the supervising forester. A few of the more common methods will be briefly mentioned here and detail of more unusual ones and of new developments will be included as they become available.

Those phases of the methods covered under the heading, "Planting Rules" will not be repeated here.

#### Center Hole Method.

This is one of the most common methods and possibly the best for planting nursery stock. It is applicable to rooted cuttings. If competing vegetation is sufficient to warrant, a rectangular scalp, one to two feet square, should be made on the planting site. In most instances this step will be unnecessary. A hole sufficiently large to hold the roots of the plant without bending or crowding is next made in the center of the spot with a shovel or mattock.

#### Slit Method.

The slit method is a more rapid but less desirable means of planting nursery stock. It is accomplished with a rather heavy planting dibble with flat blade about  $3\frac{1}{2}$  inches wide and longer than the roots of the stock to be planted. The dibble is plunged into the ground vertically with blade parallel to the body, to the full depth of the proposed hole. The handle is then pushed forward and an hour-glass-shaped hole is opened. A new purchase is obtained by sinking the dibble another inch or more and a hole is opened by pulling the handle toward the body. This method has the disadvantage that the roots are crowded into a flat





plane. There is more possibility for air pockets. This method should not be used in heavy compact clay soils. The slit method or its modifications is applicable to planting small cuttings and rooted stock.

#### Water Pocket Method.

This method is used on hillsides where each plant is placed in a small excavation one to two feet across. The material taken out should be used to construct a low ridge around the lower edge of the area so that a basin is formed. These basins catch and hold water which runs down the slope. Actual planting may be by either method described above, the plant occupying the center of the basin. An added insurance for moisture is the establishment of short wing trenches on either side to catch run-off.

#### Contour Ridge or Blocked Furrow Method.

Contour furrows are established on slopes, the ridge being on the lower side. Plantings are made in the furrow. The furrows should be dammed or blocked at frequent intervals as there are variations in slope and they are rarely positioned on the contour. The furrow spacing should be based upon the type of planting to be made. Diversion of run-off water originating above the planting area may be necessary.

#### Cuttings.

##### Vertical Method.

There are three generally accepted methods of planting willow cuttings: vertical, angular and horizontal. Of the three, vertical plantings are adapted to a greater range of site variables and therefore are used most frequently. Under cut banks vertical Class C and D cuttings are used almost entirely as they are able to withstand bank sloughing. Then, too, they can be planted to greater depths than by either of the other methods.

Lack of moisture and poorly aerated soils limit the use of vertical plantings. Vertical cuttings must be planted to live water, or to depths where the soil will remain moist until the cutting is well established. On poorly aerated soils the vertical method should not be used, as the horizontal method usually gives better results at lower cost.

For depths of four feet or less shovels are the most satisfactory tools to use for planting larger cuttings. For depths over four feet the post-hole digger, auger or spoon type, is the most practical. A crowbar is often essential, as it can be used to advantage when the underlying soil contains coarse gravel or boulders. Small sized cuttings may often be pressed into the ground to the proper depth or planted with the aid of a planting bar.



All vertical plantings should have the soil well tamped and packed. Often it may be necessary to refill and pack the hole with better soil than was removed during the excavation. This is desirable when the material removed contains coarse sand or gravel, and costs will not be excessive. The better soil used to refill the hole should be of texture and structure to contain a high percent of moisture and nutrients which will be available to the development of young root systems.

Cuttings may extend above ground almost any length, depending on their size. In the interests of economy short cuttings have a decided advantage when conditions will permit their use. Low cuttings are also favored because they afford additional protection due to their nature of sprouting at or near the surface of the ground where maximum protection is usually needed. Class A cuttings should not extend more than two inches above the ground surface.

#### Angular Method.

Angular willow plantings consist of placing willow cuttings in shallow trenches in harmony with the slope of the banks and at approximately right angles to the stream flow.

A shallow trench is dug on the face of the bank with a grub hoe, mattock or shovel. The cutting is placed in the trench and covered with soil until the upper side is alternately exposed and covered. In some instances it may be necessary to anchor the cutting by means of wooden stakes and No. 9 wire. On sites suitable for this type of planting, growth will usually take place along the full length of the cutting, forming a continuous mat of vegetation.

#### Horizontal Method.

This method is quite similar to the angular method except the cutting is placed horizontally in a shallow trench. In planting, all but the upper side of the cutting is covered with earth. If deemed necessary, they may be anchored or tied together to prevent them from washing down stream. Horizontal plantings are limited to areas where permanent water is close to the surface of the ground. The method has been utilized with success in planting sites where other methods of planting have failed due to undesirable soil and moisture conditions. Many areas are too wet to permit proper soil aeration. Where such conditions have been encountered horizontal plantings have proven successful.

Aside from use under adverse soil conditions as noted, this method may be used to advantage over vertical and angular methods of planting, particularly if moist conditions are favorable on the ground surface. Horizontal cuttings produce more sprouts and vegetation per cutting at lower planting cost than do either the angular or vertical cuttings.





### Direct Seeding.

There will probably be but few places in this region where direct seeding can be successfully practiced. Where reasonable results appear possible, costs of direct seeding will be considerably lower than when rooted stock is used. The main purpose of mentioning direct seeding here is to suggest its practice where successful results seem possible. It should hardly be necessary to add that plantings of this character will be experimental in nature and are suggested to be sure that no possibilities of vegetative establishment by artificial means are being overlooked. In many situations rodents are a controlling factor. The use of stratified seed or seed receiving other treatment may give better results when planted in favorable situations than unstratified seed.

Most seed should have some treatment before being planted. This treatment varies widely with different species, and directions covering treatment should be obtained from literature or from the Nursery Section for the particular seed to be used.

Results of direct seeding trials should be reported so that more information concerning possibilities of direct seeding may be made available.

### Ground Preparation.

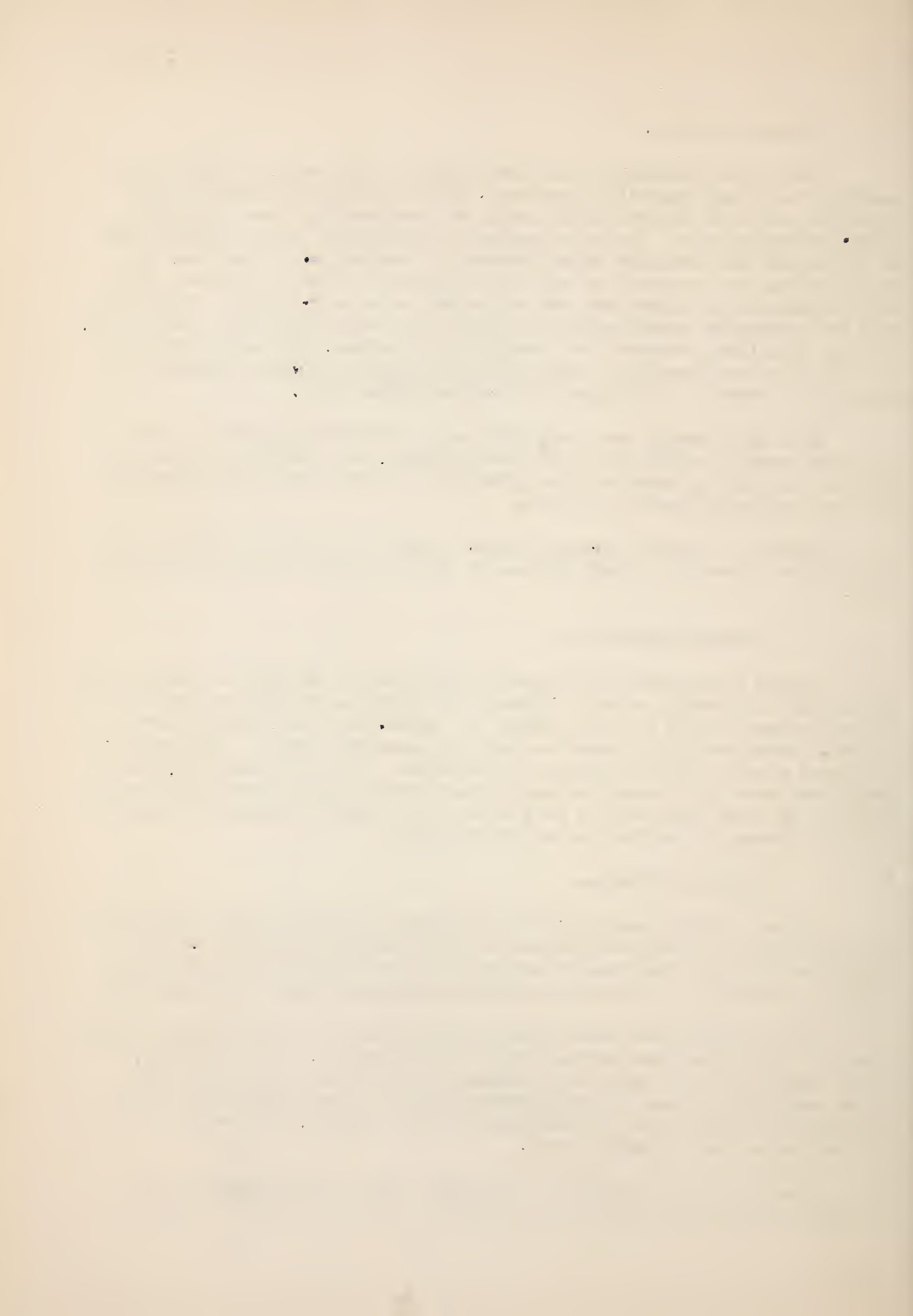
Ground preparation for direct seeding may be similar to that described for use of planting stock. Plowing and listing, or contour furrowing of small areas should be made unless too severe erosional hazards are involved. Such treatment should be made the preceding season, if possible, to assure a more favorable supply of moisture. In most instances, however, each seed spot should be cultivated, preferably the preceding season, although in many instances it is realized that ground treatment considerably in advance of seeding is not practicable.

### Planting Methods.

Actual methods used in the performance of direct seeding work will vary with site and seed conditions and with the depth at which seeds should be planted. The time of seeding is most important in order that advantage be taken of favorable conditions assuring plant establishment.

In most instances seed should be stratified or should receive other treatment to hasten germination before it is planted. As an example, in using stratified seed where the radicles have broken through the seed coats care must be used in transportation to keep the seed moist and in planting to be sure that the radicles are not damaged. The use of a hoe is recommended as a planting tool.

When seed to be planted do not show radicle development or are in such condition that they can be handled with less care, the simplest





method is to drop the seed or seeds on the prepared seed spot, force them into the ground with a straight down -- not twisting -- motion of the ball of the foot and then cover them with a side movement of the foot. An alternative, allowing for a little deeper planting, is to make a small hole in the center of the seed spot with a side motion of the foot, drop the seed or seeds into the excavation, and cover them with an opposite side motion of the foot. Either of these methods is fast, but will work, of course, only on comparatively soft ground and for rather shallow planting. If it is necessary to plant deeply, a hole can be made with a stick and the seed covered.

#### D. PLANTING REPORTS AND RECORDS

##### 1. Planting Plans.

Planting plans will be made for all woodland plantings prior to operations. Plans should be made sufficiently in advance of planting to provide a basis for requests for nursery stock. Plans must also be in sufficient detail to furnish understandable information to the planting foreman.

##### Preparation of SCS Woodland Form No. 1.

In preparing individual planting plans SCS Woodland Form No. 1 will be used as a permanent planting record and will furnish basic data for evaluation surveys. This form will also provide an estimate of labor, transportation needs and planting supervision as well as quantity, location, spacing and arrangement of species to be planted. The reverse side will be used for detailed sketches of species arrangement and additional information needed. This form is to be prepared in the field by the woodland representative of the planning party or by other technicians assigned technical responsibility for woodland activities.

##### Maps and Charts.

Since it may not always be possible to show sufficient detail on the planting plan, additional maps or supplements may be made. Too much emphasis cannot be placed on the importance of furnishing clear and concise information to the planting foremen for field guidance.

##### 2. Posting of Quantities of Estimated and Actual Planting Stock.

Posting of planting materials is necessary to present to the region on September 1 annually field requirements for the next planting season. During the year a report is also required which notes quantities of stock actually planted. The stock tabulation sheet presented on Page 18 is a handy form for use. It is noted as a suggestion only, and any type of form which necessitates a minimum of work can be used for posting purposes.





Pasture #	Structure #						
Field #	Type						
Survey By	Date						
Acres	Lineal Ft.						
Present Cover Ranch							
Present Cover Work Area							
Surface Soil	Subsoil						
Adverse Soil Factors							
Inherent Fertility							
Moisture Relationship							
Other Site Factors							
Erosion-None	Rills	Gully	Sheet	Wind	Depos	Cut	Remarks
Light							
Moderate							
Severe							
Very Severe							
Purpose							
Remarks							
Sketch Map or Notes							
Sec.	Twp.	Range					

District Ranch or Area		Plan No.
Supervised by	Date	Acre
Planted by	Wind	Depth Soil Moist
Soil Preparation		
Planting Method		
Quality of Stock or Seed	Source	
Number of Plants or Lbs. Seed		
Species	Estimated	Actual
TOTAL		

	Unit	Quantity Estimated		Quantity Actual	
		SCS	Coop.	SCS	Coop.
Super.	Man Yrs.				
Tech.	Man Hrs.				
Labor	Man Hrs.				
Truck	Miles				

NOTES - Spacing and Arrangements - Special Conditions

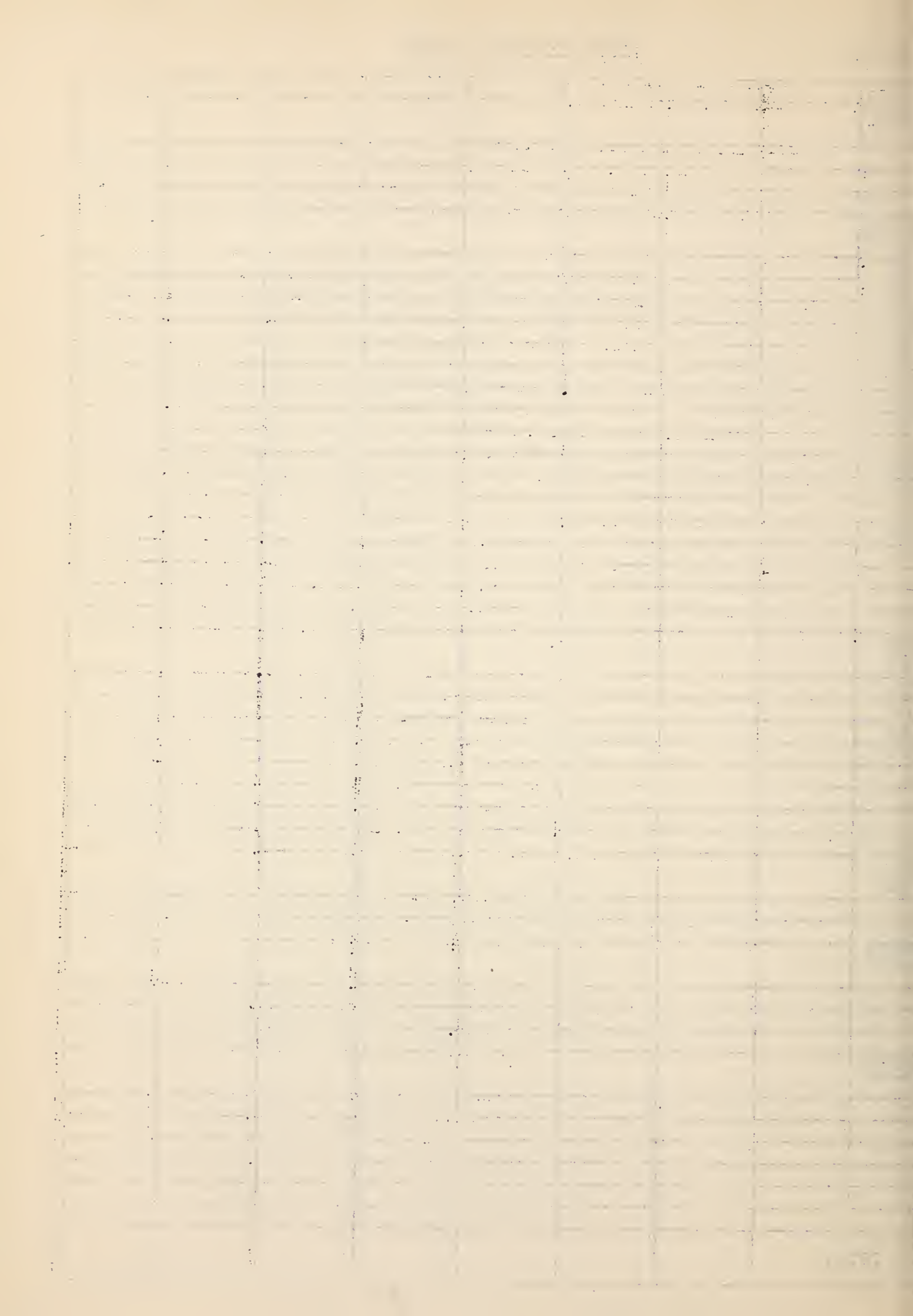
Approved by:

Attach to Form 656      Use other side for sketch.









When compiling information on estimated quantities of stock one should remember that posting should first be done only for planting plans covered by signed agreements. When agreements are approved, planting plans for such agreements can be marked by red pencil to note this fact. These planting plans may then be placed in files, one file containing those plans to be executed by a given CCC camp or by SCS work forces. At any time the plans in any of these files may be totaled for each agreement by running through the plans for a given unit, totaling quantities of stock by species, entering the totals for each species by agreements on the stock tabulation sheet. Totaling of stock for a given work unit will give partial quantities to be shipped to any point. Additions must necessarily be made for the September 1 report to cover estimated needs from that date through the next planting season.

Actual quantities of stock planted can be totaled by following the same procedure for plans for which planting is completed.

### 3. Progress Maps.

Progress maps are valuable to present location and coverage made by planting activities. They are particularly valuable in the event of personnel replacements. Posting can be made annually after the planting season is over. By so doing a progressive pictorial record is available. Naturally any degree of detail can be shown. For simplification, however, it is suggested that a minimum of detail be shown. The planting areas can be indicated and the quantity of stock planted by species can be shown by symbols and numbers.

### 4. Evaluation and Observational Surveys.

Careful surveys of selected planting areas exhibiting various types and conditions of erosion needing control constitutes an activity of high priority. The job various species are doing in erosion control in the light of soil, moisture and other influencing conditions is an important field for study leading to improved techniques and lower costs.

Preliminary consideration should be given to types of planting sites where surveys should be made. One should be careful not to establish too many areas for survey of planting effectiveness of but one type of erosion condition. Considering all site variations and what we know about control by planting on each of them, district and area foresters should develop for guidance a logical master survey plan which should note survey priorities, and will approve planting surveys proposed by members of their staffs as prepared in conformance with priorities noted by the master survey plan. Surveys of various types of gully and arroyo plantings should be given major consideration since we know altogether too little about them.

Areas selected for survey should only be large enough to provide a suitable sample to meet the requirements of the study. Permanent markers





will be necessary to delineate the boundaries of the survey area. A notation as to quantities of plants by species in the survey area should be made at the time planting is done.

Provided only a part of the planting area covered by the planting plan is designated for survey, the location of the portion selected should be shown on the planting plan. Maps should be prepared for observational plantings. The progress map should show areas selected for surveys.

A form for recording part of the information obtained from the survey appears on the following page. Survival data should be procured by making a complete count on the survey area. Initial planting costs should be obtained at the time the planting is made. You will also note that the form calls for a description of the type of erosion conditions on the area at the time the study is initiated. This description should be clear, concise and accurate.

At the time a survival count is made the observer should prepare brief dated notes covering the present erosion-control effectiveness of the planting, causes of mortality, protection needs and other pertinent factors affecting the results obtained and refer to the planting plan for pertinent basic information. Based upon an analysis of these data in the field he should state his conclusions as to proposed changes that would result in more effective control of erosion for improved application elsewhere. These notes and diagrams should be attached to the form constituting a part of the record. The point to be made is that of periodic evaluation so that plantings can be made more effective.

Assistance should be obtained from members of the Soils Section. Properly located photographic repeat stations will prove advantageous.

An overall survey work plan covering all planting surveys will be prepared by the region and submitted to Washington for approval. By so doing we hope to obviate the necessity of preparing work plans for each survey area as required at present. Since observational surveys constitute a function of the Nursery Section, foresters should work in close cooperation with representatives of that section who have been assigned responsibility for carrying out such surveys. For observational surveys, on which the forester cooperates with Nursery Section representatives, data called for by planting plan procedure should be obtained.

The whole purpose of the presentation under this heading is concerned with a determination of where to plant, how to plant, and what to plant. The results we get will indicate effective plantings we can make and their cost.

##### 5. Survival Records.

An annual survival report form presented on Page 13A of the Woodland Section of the Manual will be submitted to the regional office on or

Planting Plan No. \_\_\_\_\_

### Initial Planting Costs

# Rate Cost Based on Survival

NOTE: Cost Basis will be cost per tree surviving



## EVALUATION AND OBSERVATIONAL SURVEYS

District or Area

Cooperator

Date Planted

[illegible]





before December 1 covering plantings made the previous fiscal year. For the present procedure covered in Regional Bulletin No. 9 will constitute the basis for field survival studies.

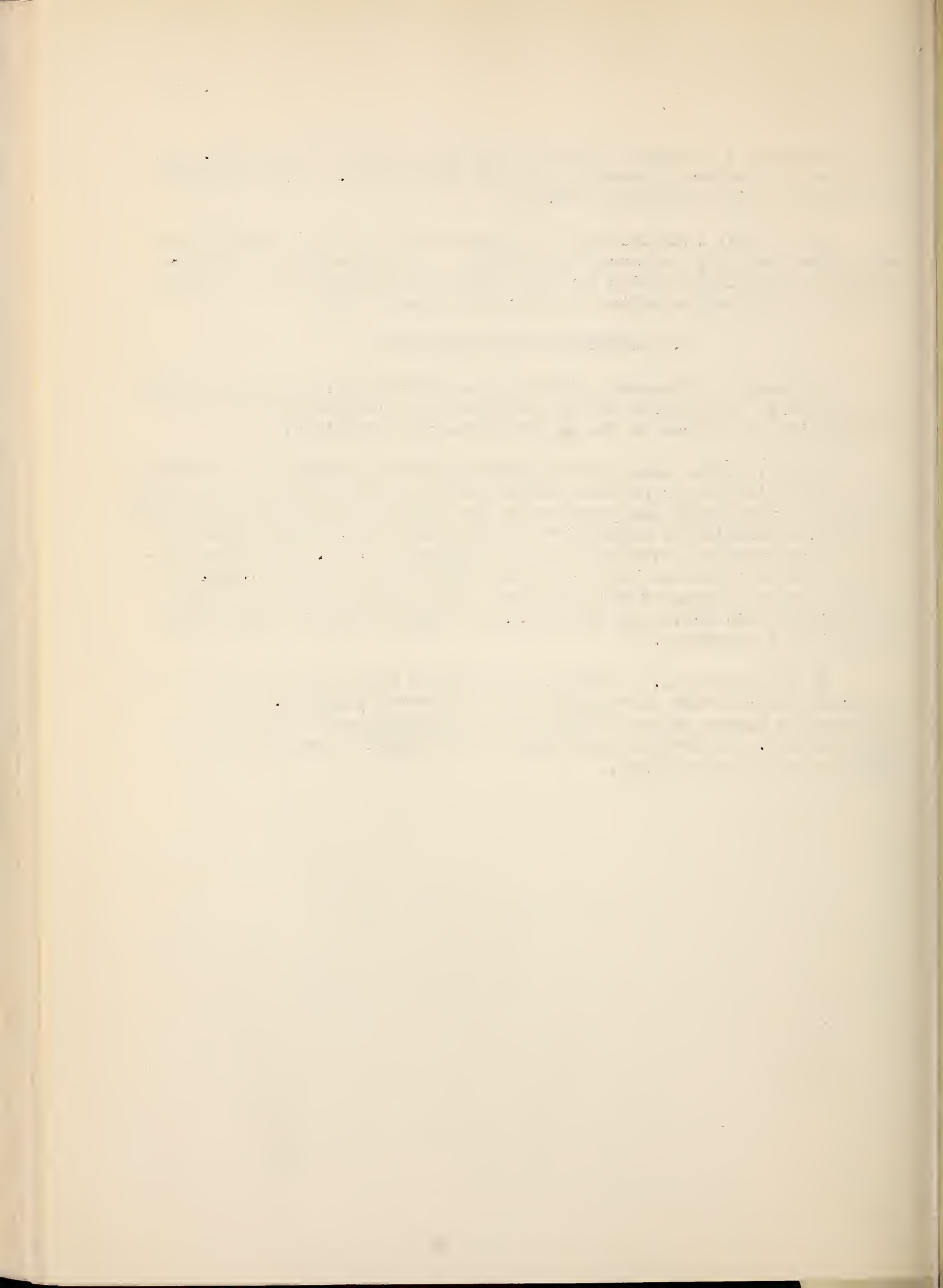
It is fully realized that it is impossible to obtain proper survival data for gully and arroyo plantings. A consideration of the inadequacy of survival studies for this class of plantings will be taken up with the Washington office to determine future action.

#### E. MAINTENANCE AND REPLANTING

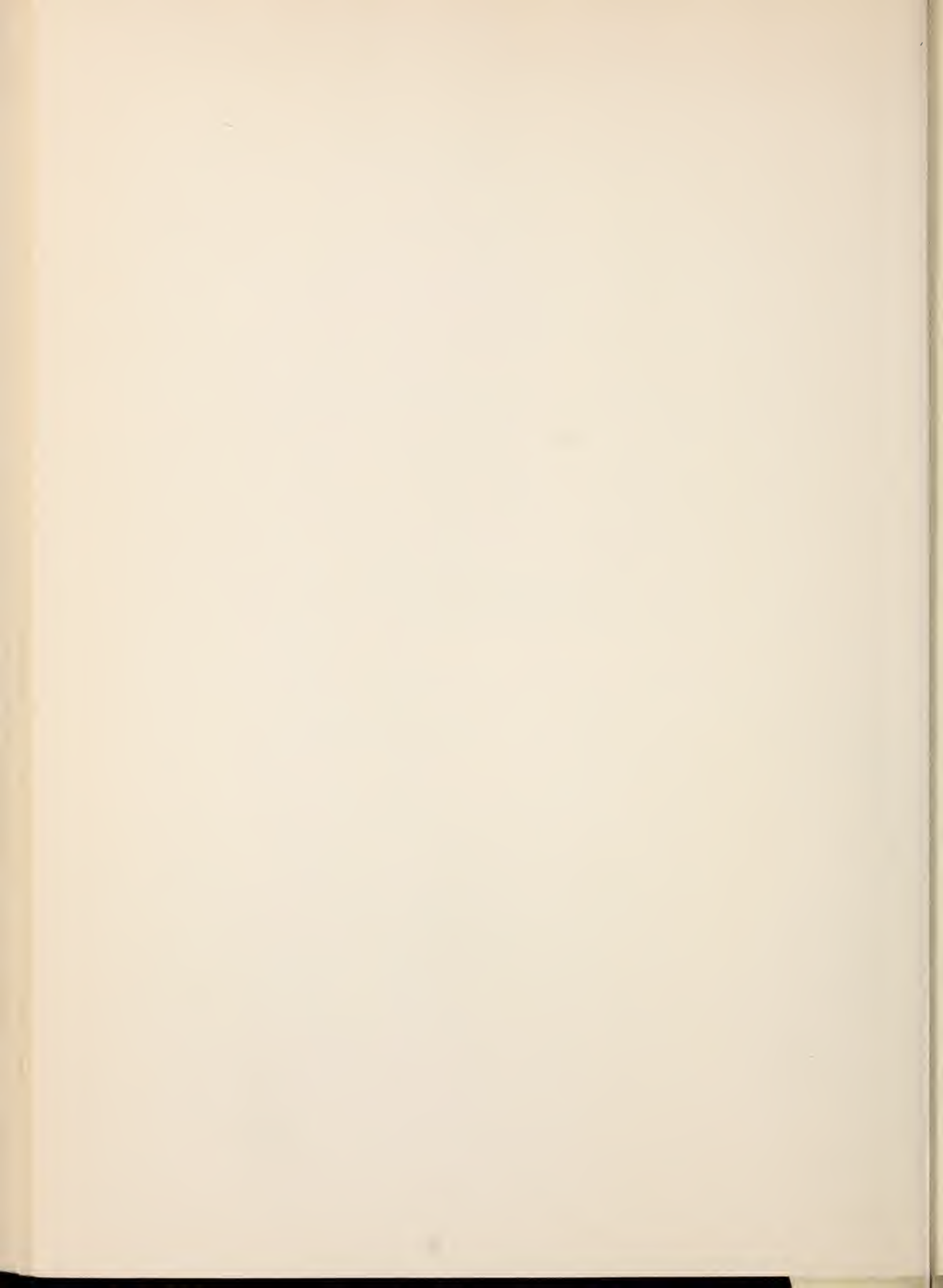
Necessary maintenance activities as cultivation, irrigation, weeding, etc. will be required of the cooperator and covered in the plan of conservation operations as the cooperator's responsibility.

Where failures occur sufficient to materially reduce the effectiveness of the planting, replanting should be done. Provided the cooperator can obtain cuttings on his property or can otherwise procure them readily, he should ordinarily be required to replant where this material can be used effectively and coverage in the agreement provided. Replanting requiring rooted stock can be done by the cooperator or by the S.C.S. depending upon the terms of the agreement. The Woodland Section of the Manual (Page 11A) indicates the S.C.S. can supply stock in cases where replanting is necessary.

In all instances, a critical examination should be made of planting areas before stock is requested for replanting purposes. This is necessary to insure proper consideration of changes to be made in the original plan. If changes are required they should be recorded and attached to the planting plan.



A P P E N D I X





# NUMBER OF TREES FOR A GIVEN AREA AT DIFFERENT SPACINGS

AREA		SPACING							
Acres	Sq.Ft.	2x2 ft.	3x3 ft.	4x4 ft.	6x6 ft.	6x8 ft.	8x8 ft.	8x10 ft.	10x10 ft.
		Trees	Trees	Trees	Trees	Trees	Trees	Trees	Trees
.05	2178	550	225	125	60	45	35	25	20
.1	4356	1075	475	275	100	90	70	55	45
.15	6534	1625	725	400	175	135	100	80	65
.2	8712	2175	950	525	250	180	135	110	85
.25	10890	2725	1200	675	300	225	170	135	110
.3	13068	3250	1450	800	350	270	205	165	130
.35	15246	3800	1700	950	425	320	240	190	155
.4	17424	4350	1925	1075	475	365	270	220	175
.45	19602	4900	2175	1225	550	410	305	245	195
.5	21780	5450	2425	1350	600	455	340	270	220
.55	23958	6000	2650	1500	650	500	375	300	240
.6	26136	6525	2900	1625	725	545	410	325	260
.65	28314	7075	3150	1775	775	590	440	355	285
.7	30492	7625	3375	1900	850	635	475	380	305
.75	32670	8175	3625	2050	900	680	510	410	325
.8	34848	8700	3875	2175	950	725	545	435	350
.85	37026	9250	4100	2300	1025	770	580	460	370
.9	39204	9800	4350	2450	1075	815	615	490	390
.95	41382	10350	4600	2575	1150	865	650	515	415
1.0	43560	10900	4850	2700	1200	910	680	545	435

NOTE: In making up the above table, the numbers of the trees were rounded off to make it more workable.



# PLANTING STOCK

## ABBREVIATIONS

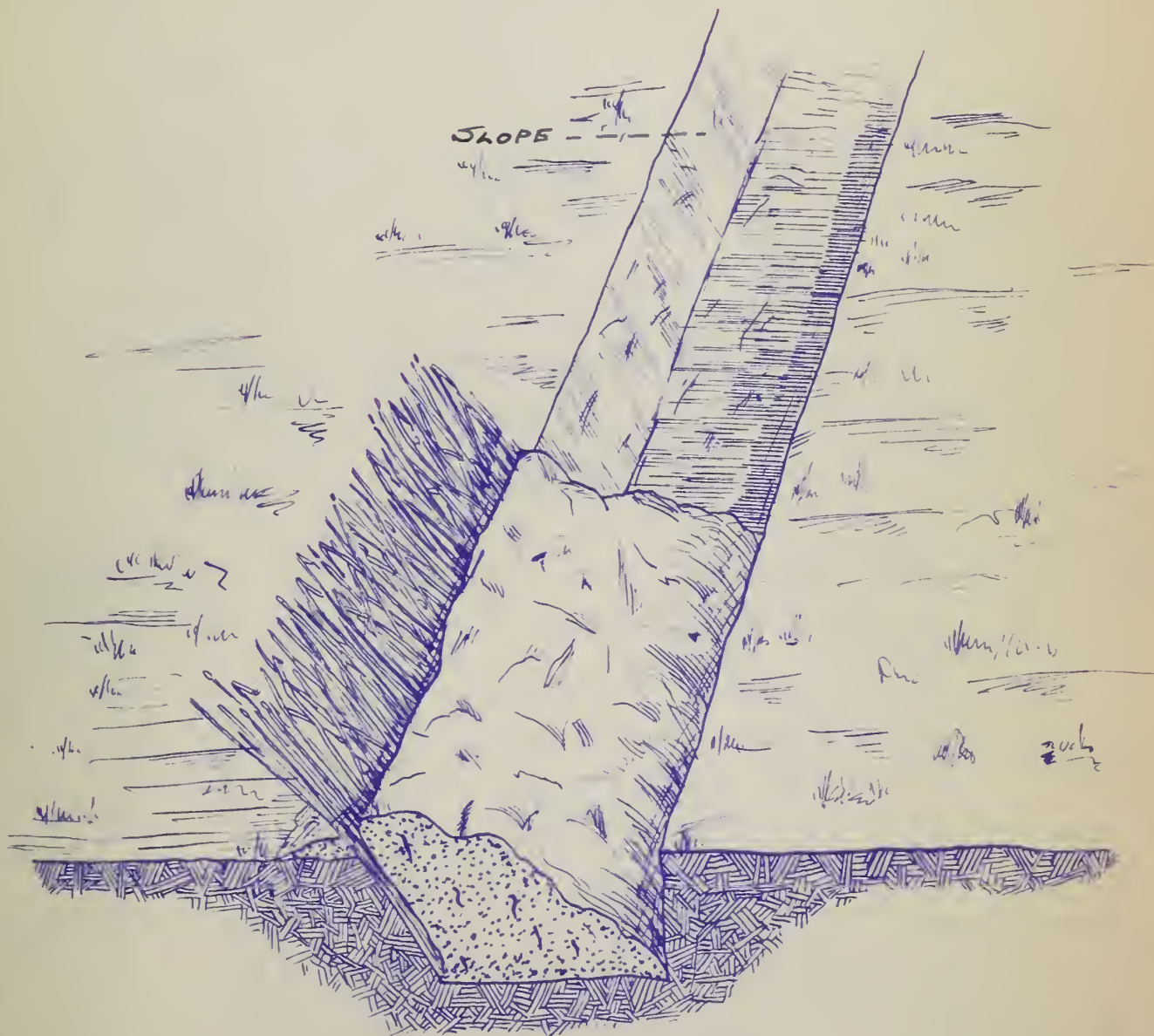
## LATIN NAMES

## COMMON NAMES

ACE ne	<i>Acer negundo</i>	Box elder
AIL gl	<i>Ailanthus glandulosa</i>	Tree of Heaven
AMP qu	<i>Ampelopsis quinquefolia</i>	5 leaf ivy
BAC gl	<i>Baccharis glutinosa</i>	Seep willow
CAR ar	<i>Caragana arborescens</i>	Siberian pea tree
CAT sp	<i>Catalpa speciosa</i>	Catalpa
CHI li	<i>Chilopsis linearis</i>	Desert willow
CLE li	<i>Clematis ligusticifolia</i>	Clematis
COL sp.	<i>Coleosanthus</i> sp.	
ELE an	<i>Eleagnus angustifolia</i>	Russian olive
FAL pa	<i>Fallugia paradoxa</i>	Apache Plume
FOR ne	<i>Forestiera neomexicana</i>	Wild olive
FRA la	<i>Fraxinus lanceolata</i>	Green ash
GLE tr	<i>Gleditsia triacanthos</i>	Money locust
JUG ma	<i>Juglans major</i>	Arizona walnut
JUN sc	<i>Juniperus scopulorum</i>	Rocky mountain juniper
MOR al	<i>Morus alba tatarica</i>	Russian mulberry
PAR fi	<i>Parryella filifolia</i>	Dune broom
PIN ed	<i>Pinus edulis</i>	Pinon
PIN po	<i>Pinus ponderosa</i>	Ponderosa pine
POP ac	<i>Populus acuminata</i>	Lance leaf poplar
POP al	<i>Populus alba</i>	Silver leaf poplar
POP an	<i>Populus angustifolia</i>	Narrow leaf poplar
POP wi	<i>Populus wislizenii</i>	Valley cottonwood
PRU an	<i>Prunus americana</i>	Wild plum
RHU mi	<i>Rhus microphylla</i>	Lemonade berry
RHU tr	<i>Rhus trilobata</i>	Squaw-berry
ROB ne	<i>Robinia neomexicana</i>	New Mexican locust
ROB ps	<i>Robinia pseudoacacia</i>	Black locust
SAL ex	<i>Salix exigua</i>	Sandbar willow
SAL ni	<i>Salix nigra</i>	Black willow
TOX po	<i>Toxylon pomiferum</i>	Osage orange
ULM pu	<i>Ulmus pumila</i>	Chinese elm
VIT ar	<i>Vitis arizonica</i>	Wild grape

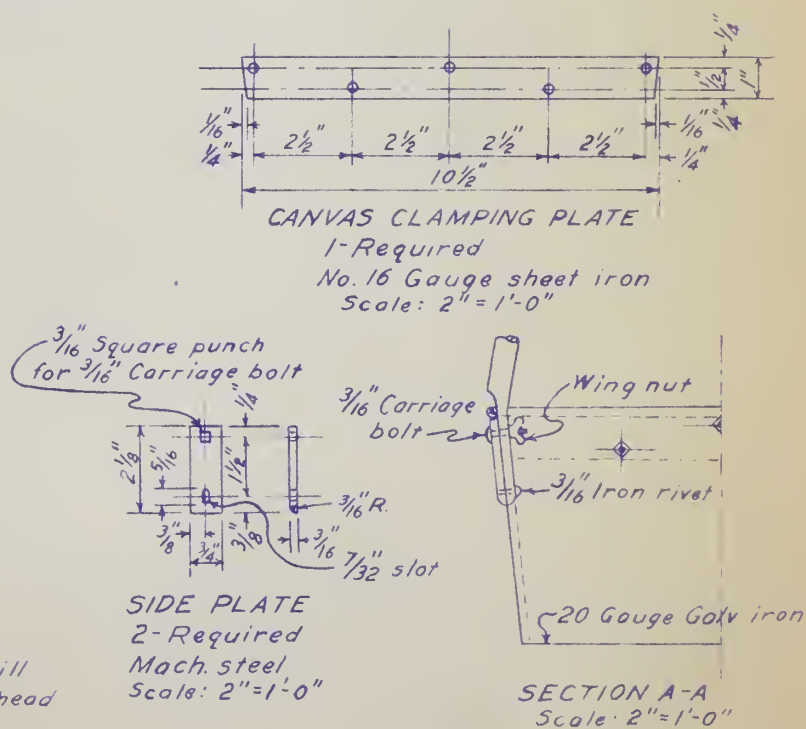
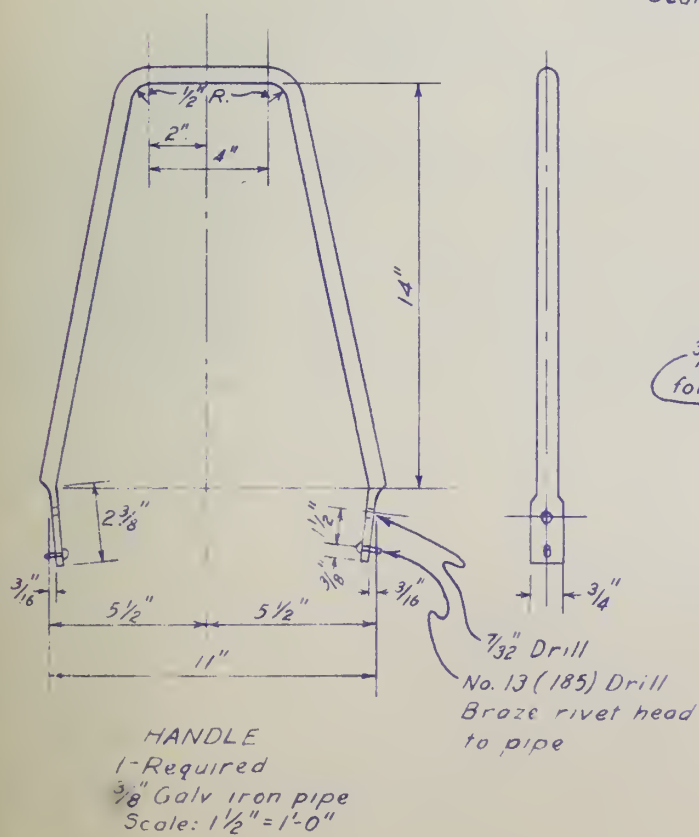
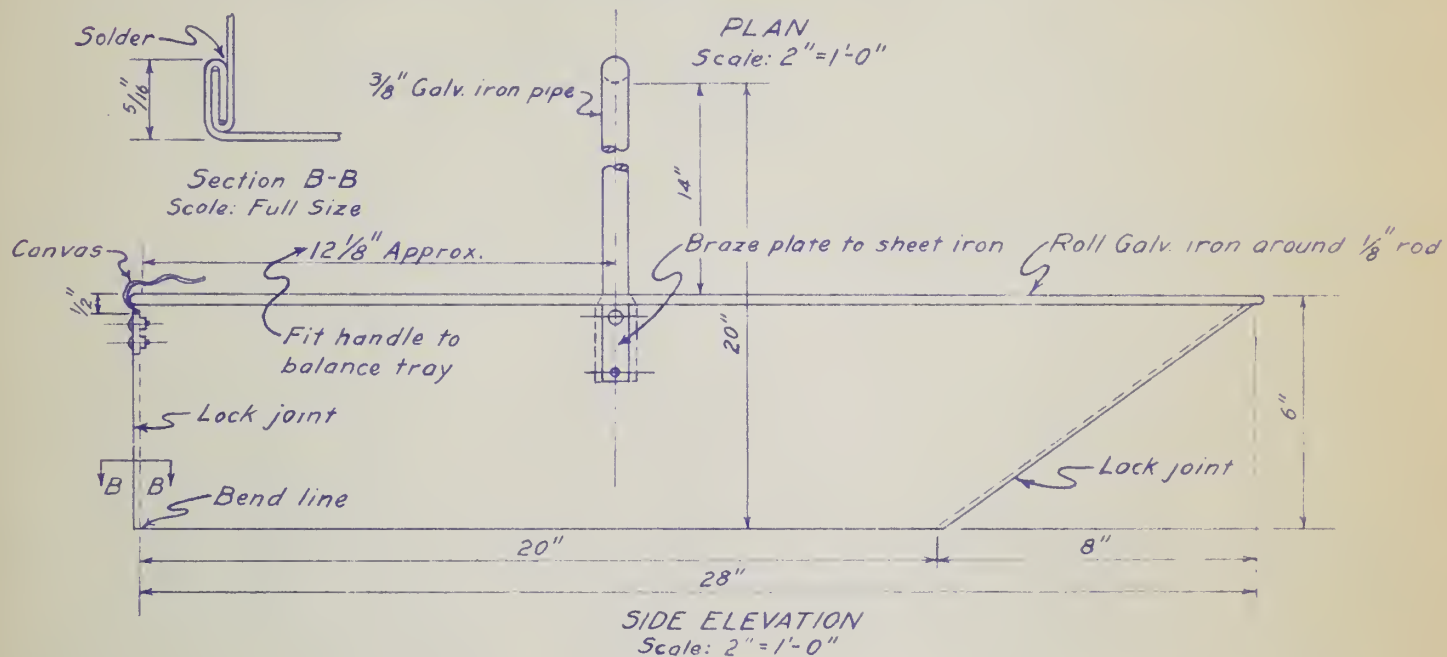
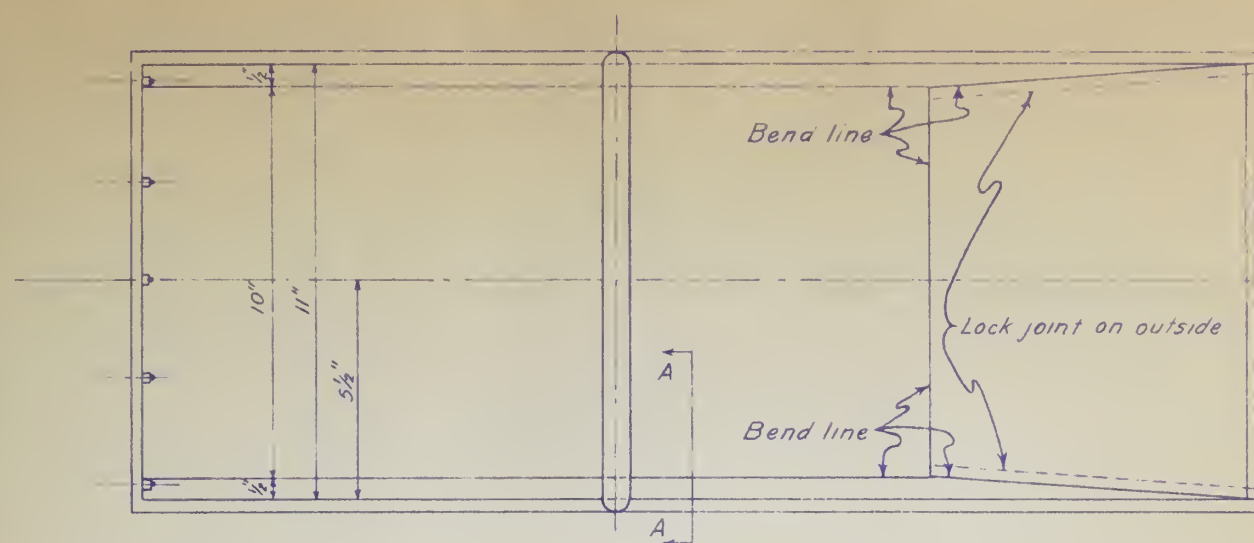






HEELING IN TRENCH

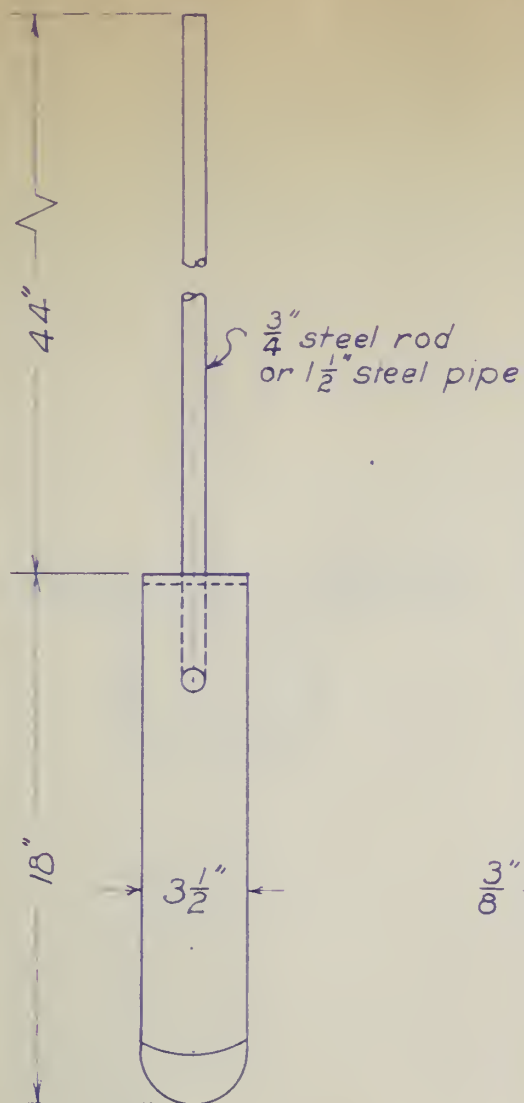




## PLANTING TRAY

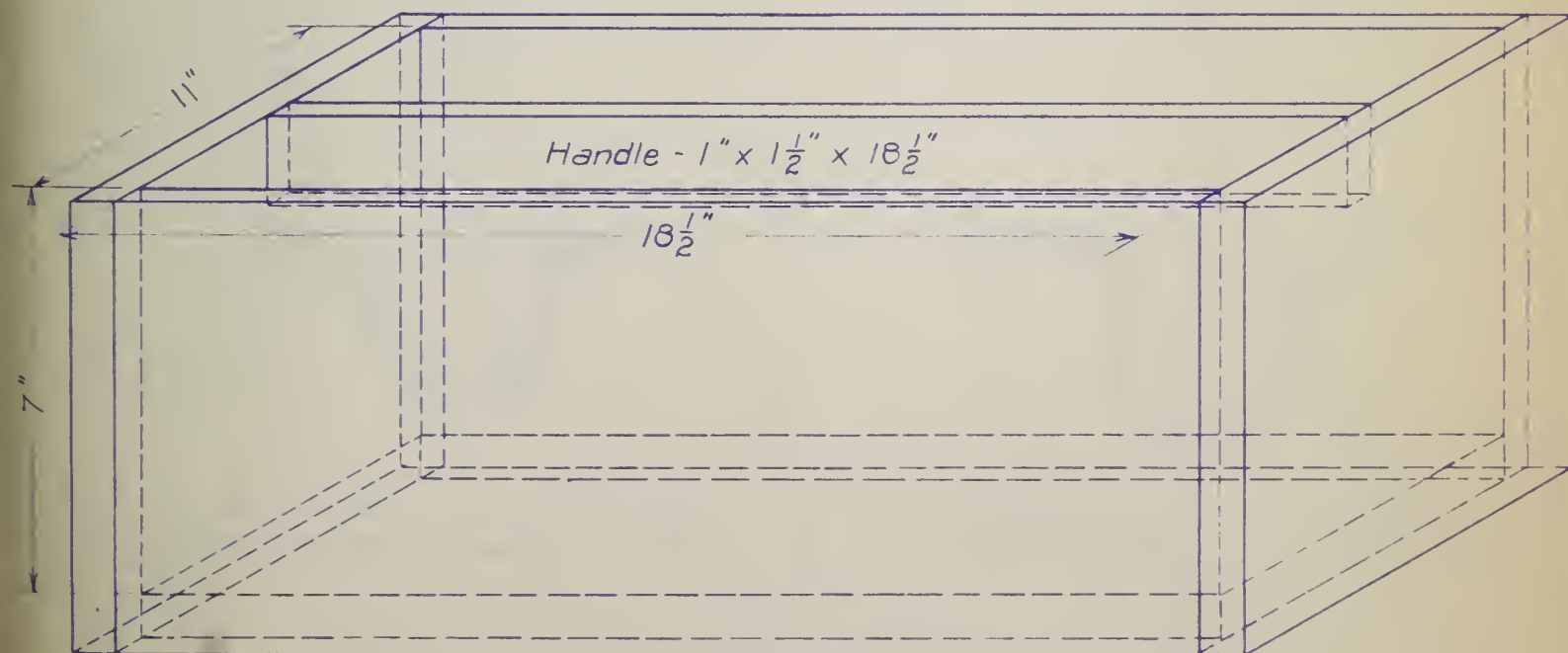






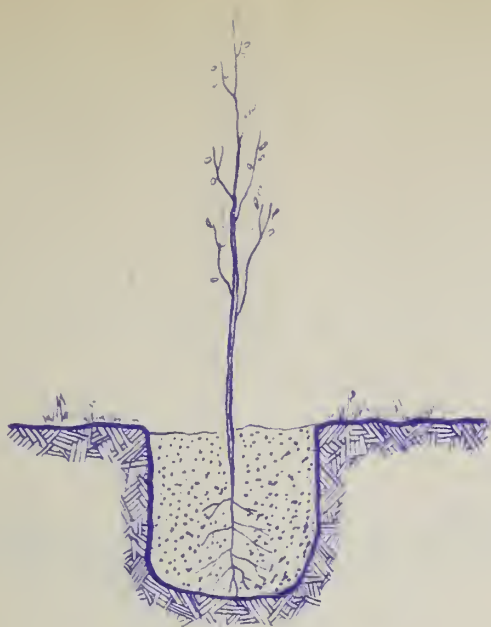
PLANTING BAR  
Scale 1/8" = 1"

Note:— Planting Box  
Inside dimensions - 7" x 11" x 18 1/2"  
Material - 1 in. stock  
Powder boxes can be remodeled  
to satisfactory dimensions.  
Box lumber & crating can also  
be used to advantage.



PLANTING BOX  
Cabinet Drawing

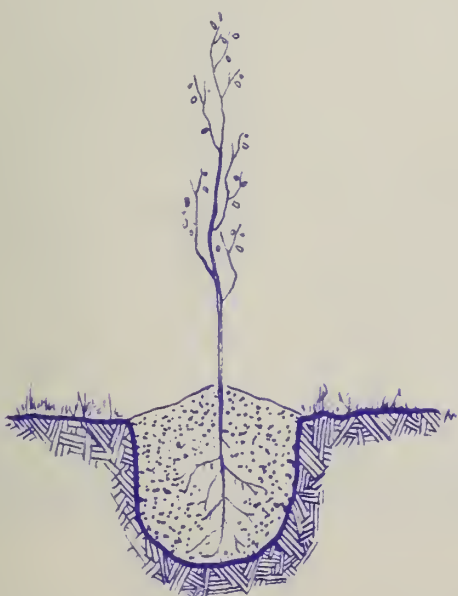




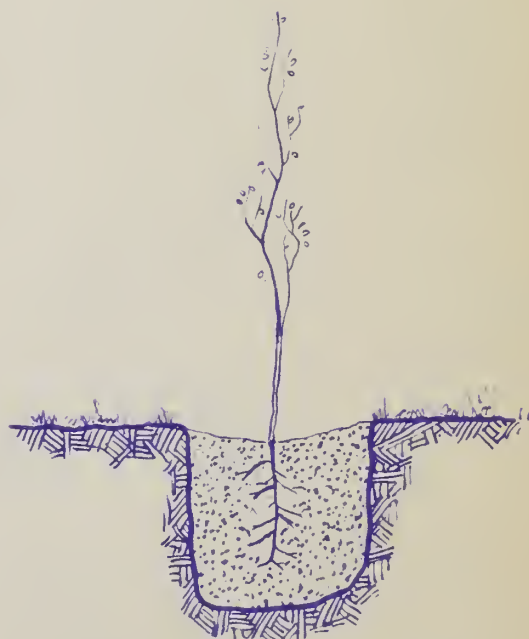
1.  
TREE TOO DEEP



2.  
TREE TOO SHALLOW

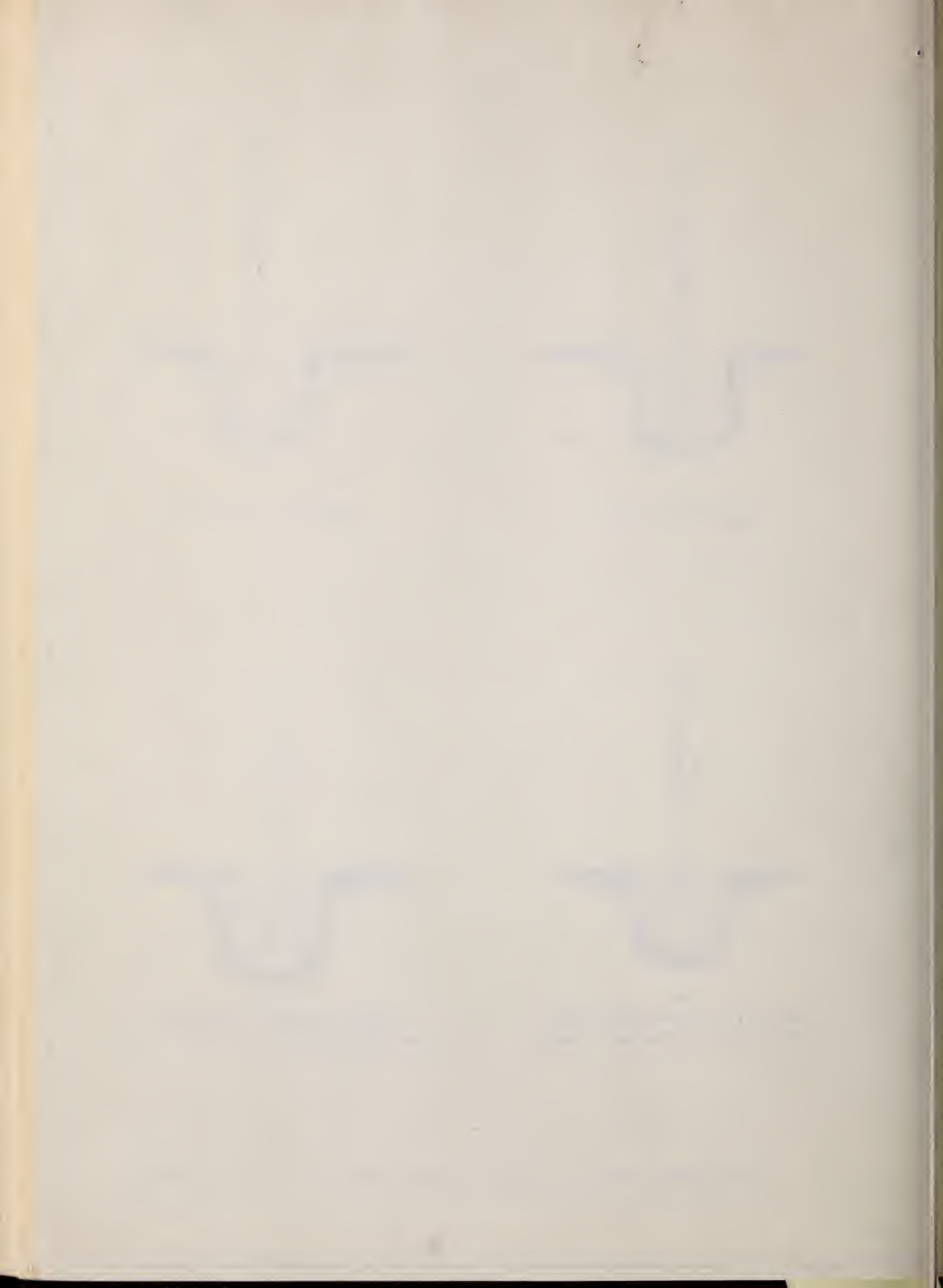


3.  
HOLE TOO SHALLOW WITH  
SOIL PILED UP AGAINST TREE

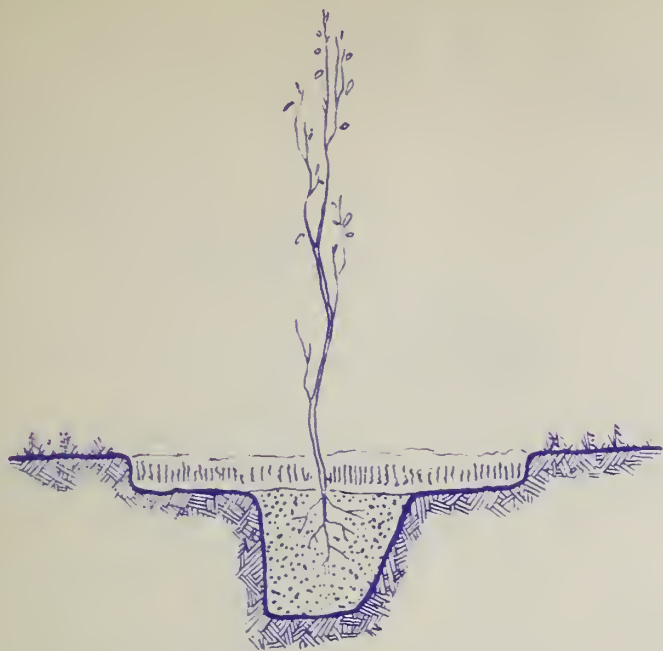


4.  
TREE PROPERLY PLANTED  
WITH DEPRESSION TO COLLECT WATER

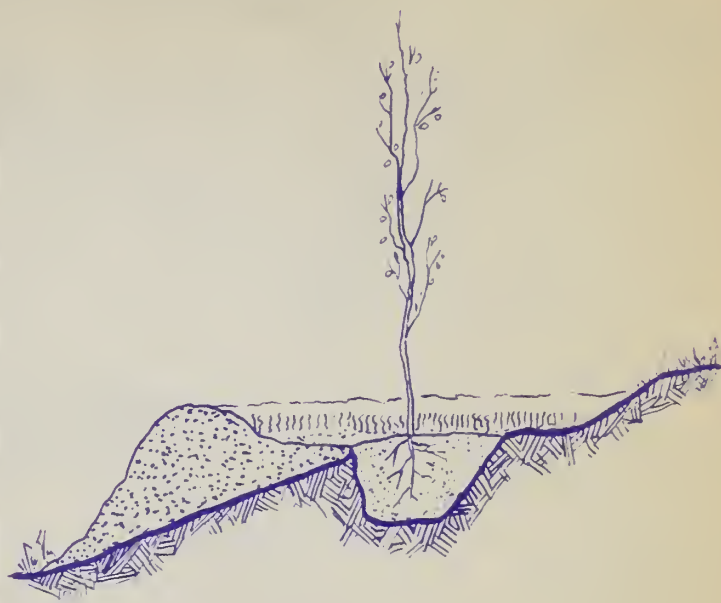
PROPER POSITION AND THREE COMMON ERRORS IN TREE PLANTING.



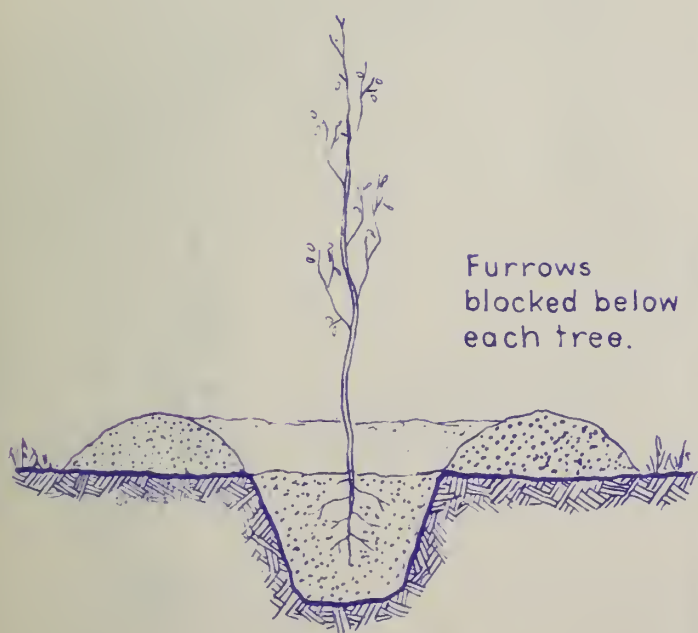




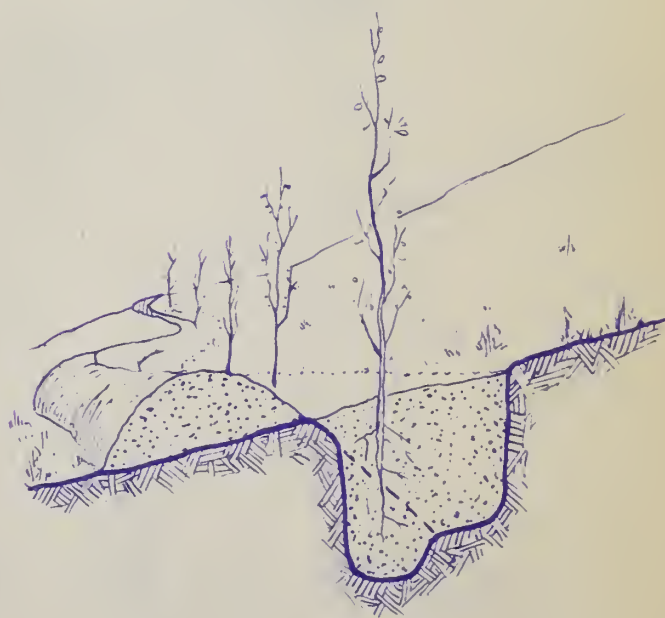
1.  
CENTER HOLE METHOD



2.  
WATER POCKET METHOD



3.  
BLOCKED FURROW METHOD



4.  
CONTOUR RIDGE METHOD

# METHODS OF PLANTING



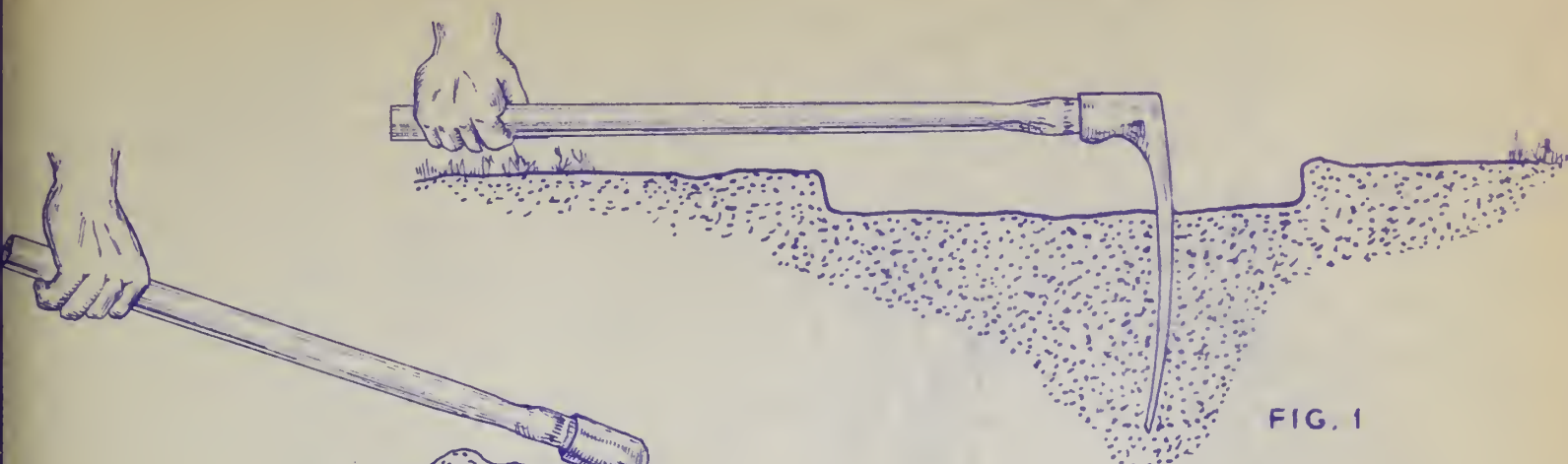


FIG. 1

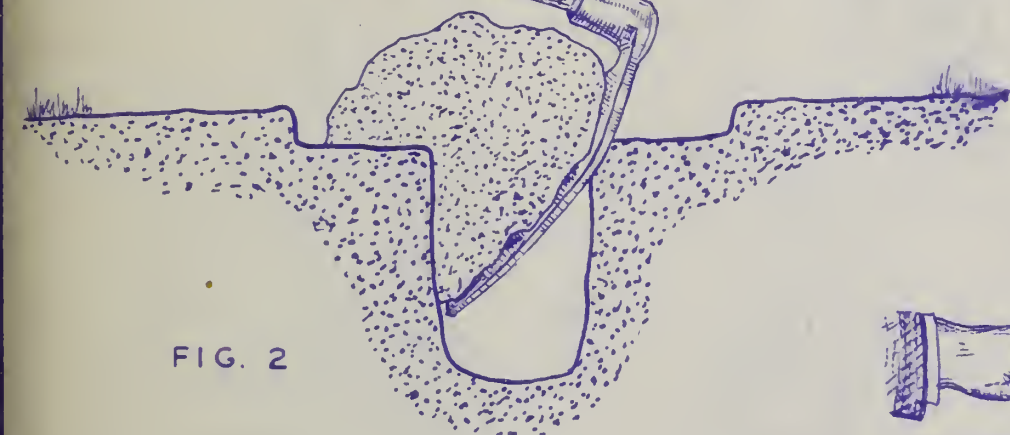


FIG. 2

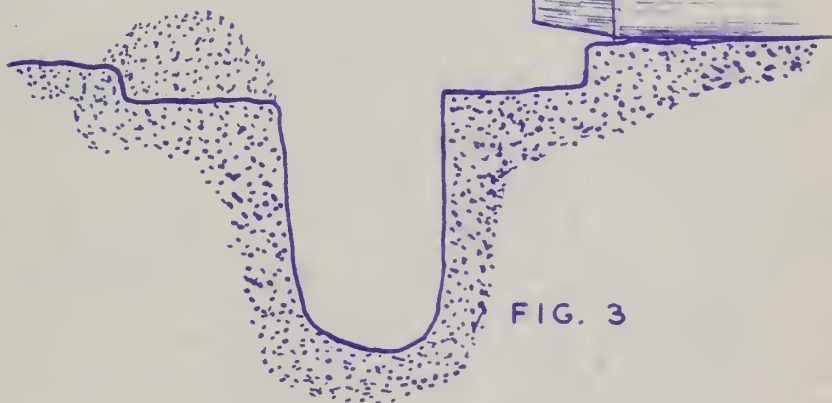
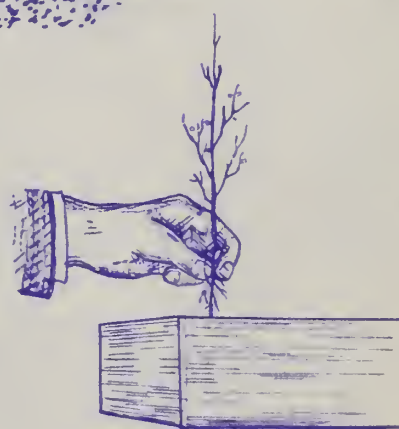


FIG. 3

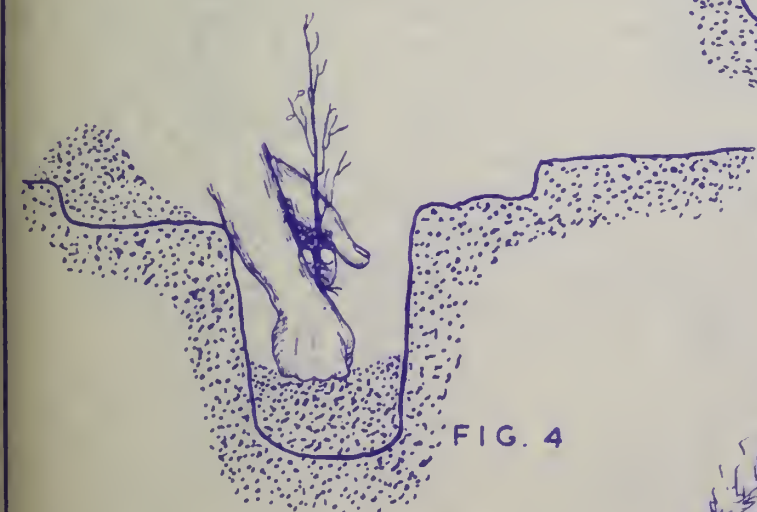


FIG. 4

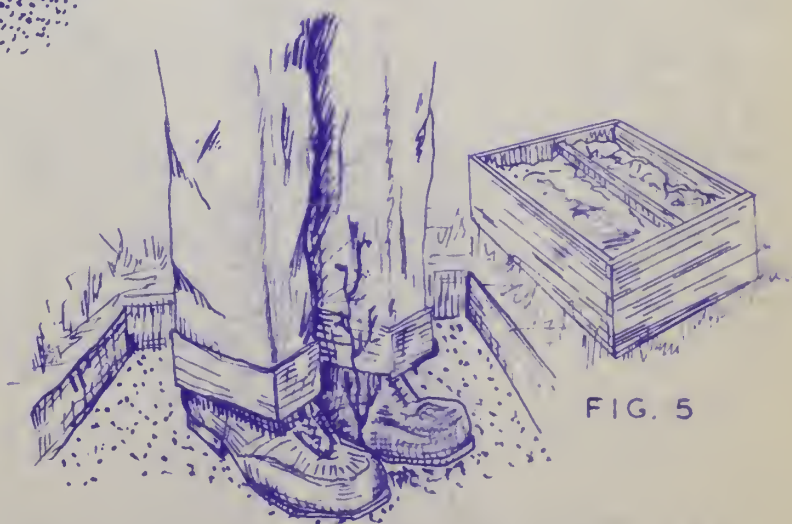
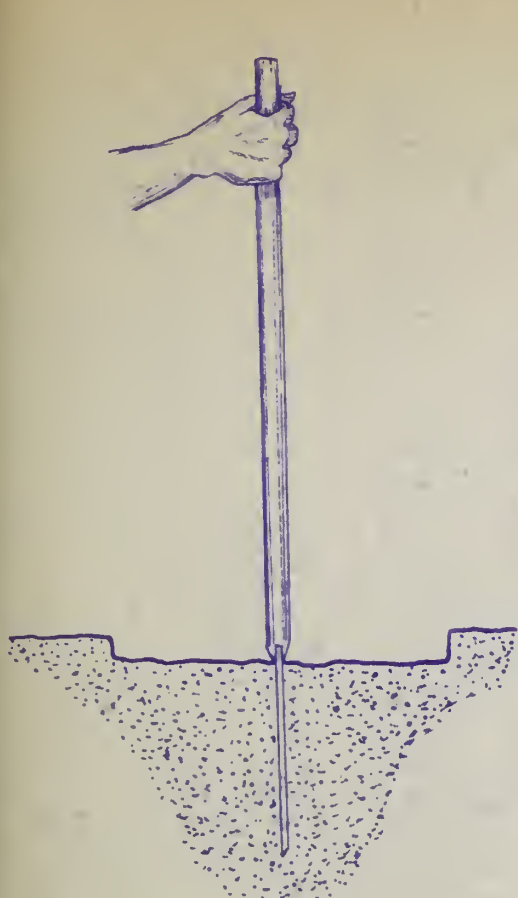


FIG. 5

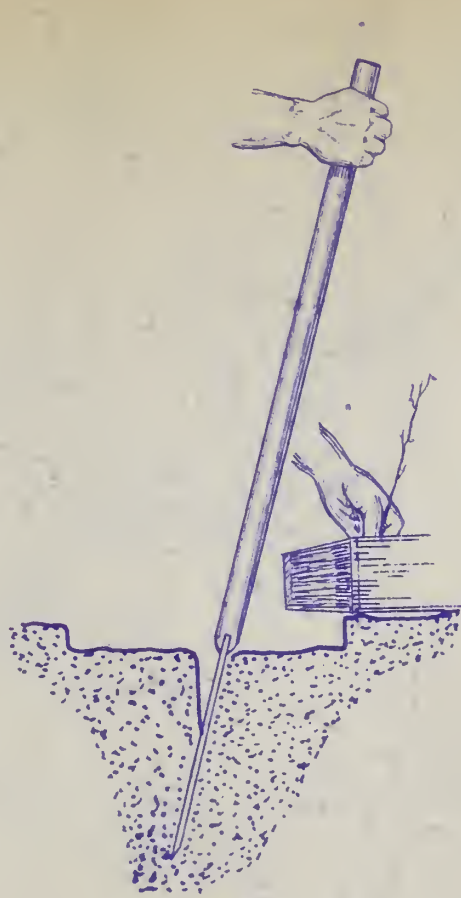
# PLANTING BY CENTER HOLE METHOD



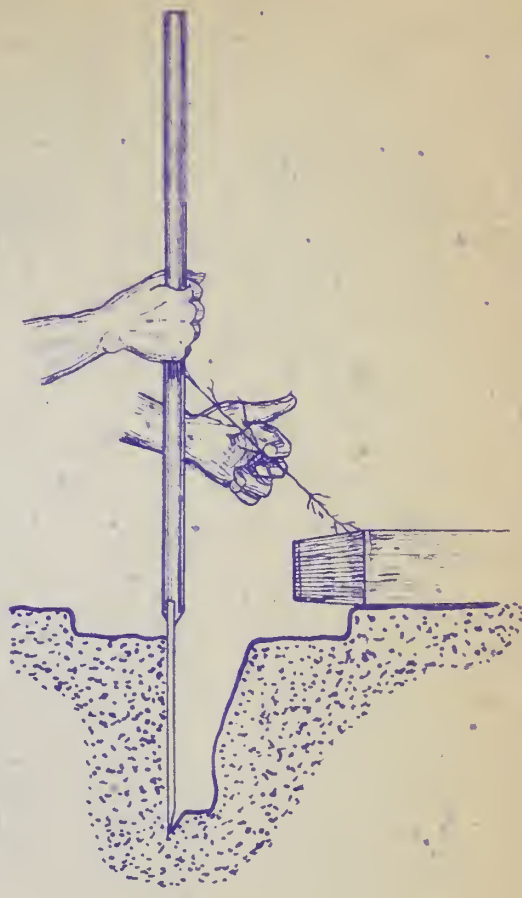




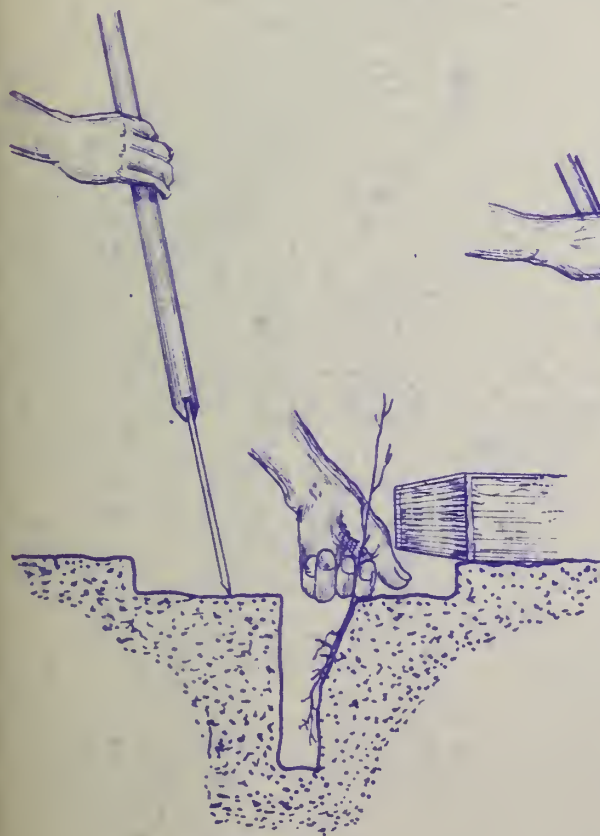
STEP 1.



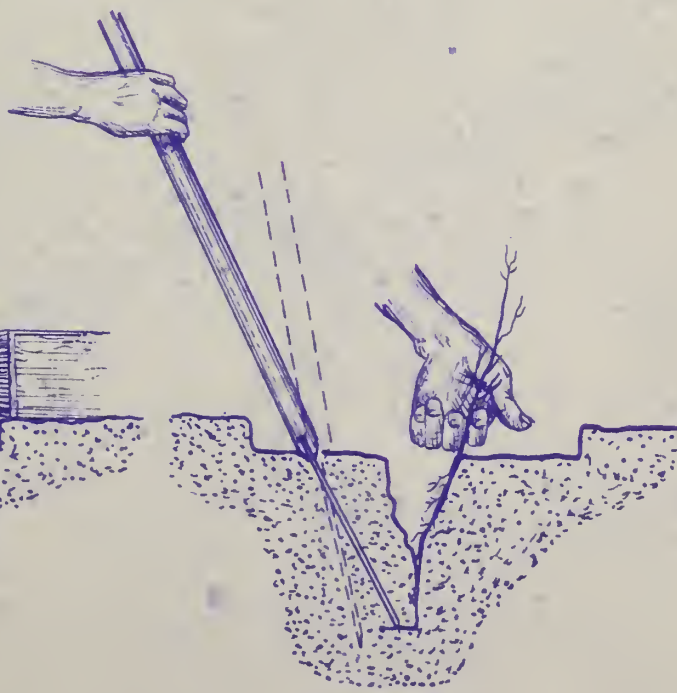
STEP 2



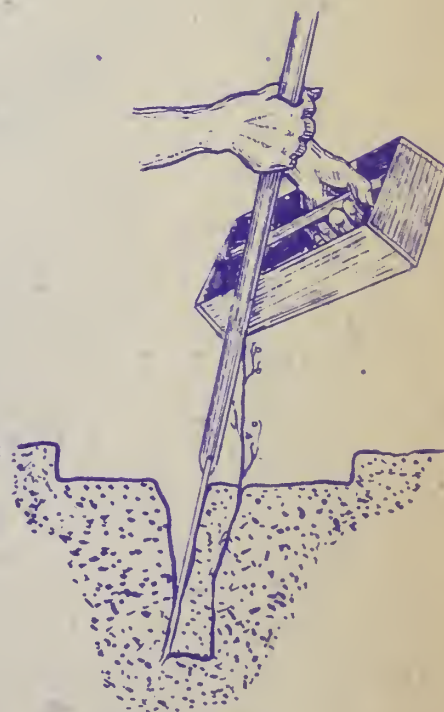
STEP 3



STEP 4

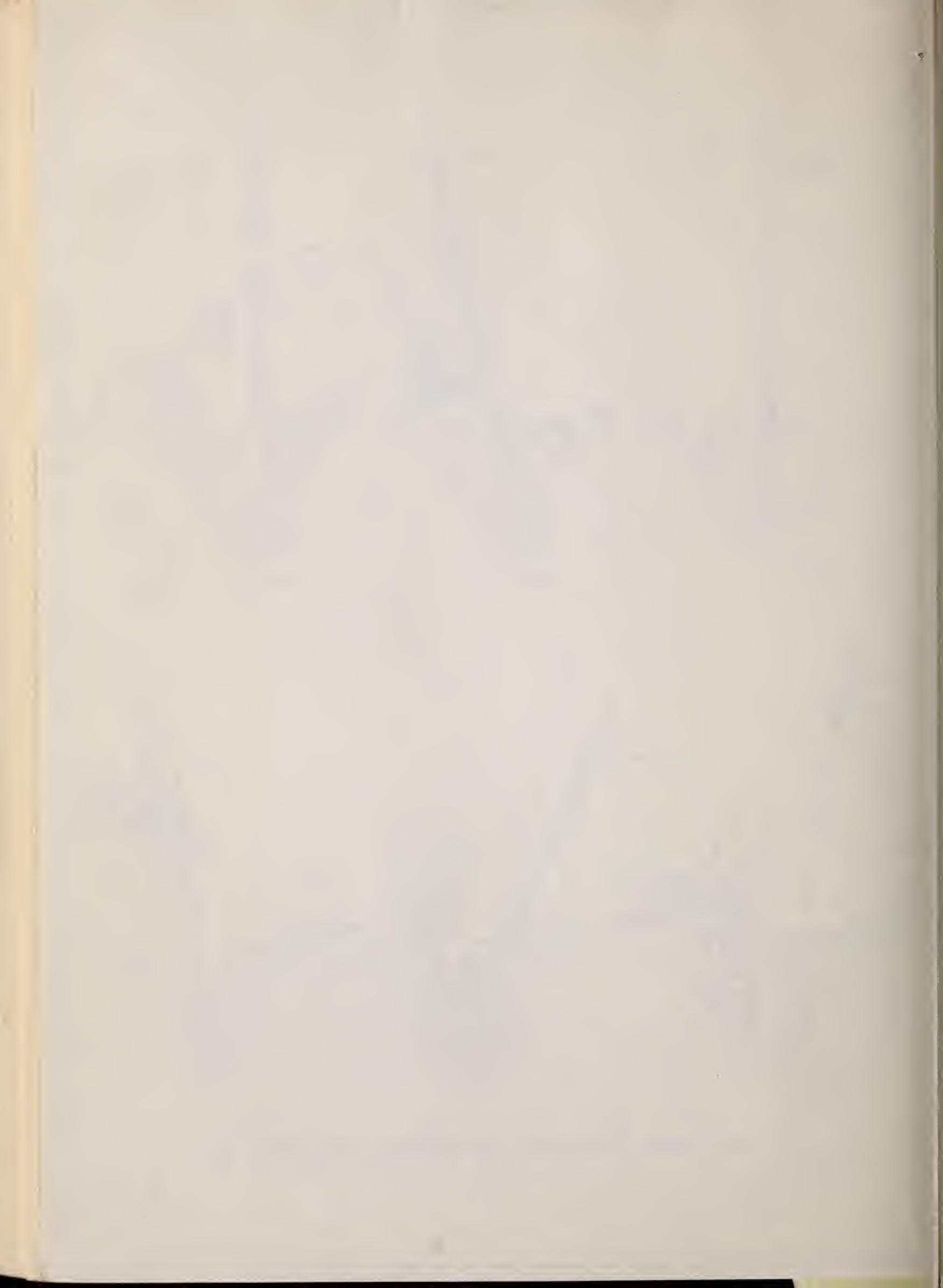


STEP 5



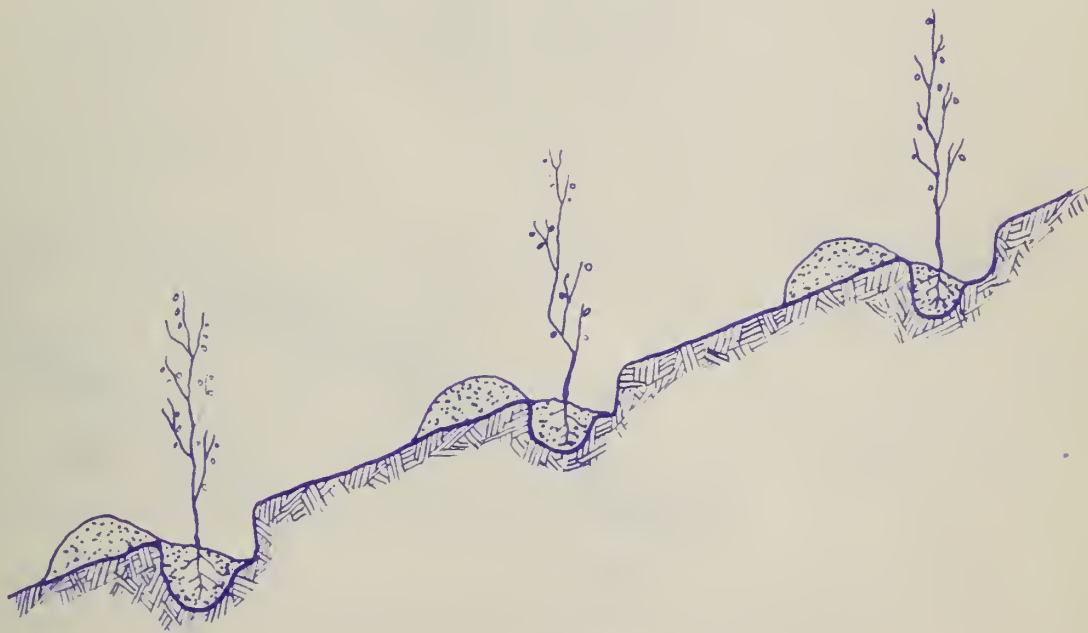
STEP 6

# SLIT METHOD OF PLANTING USING PLANTING BAR

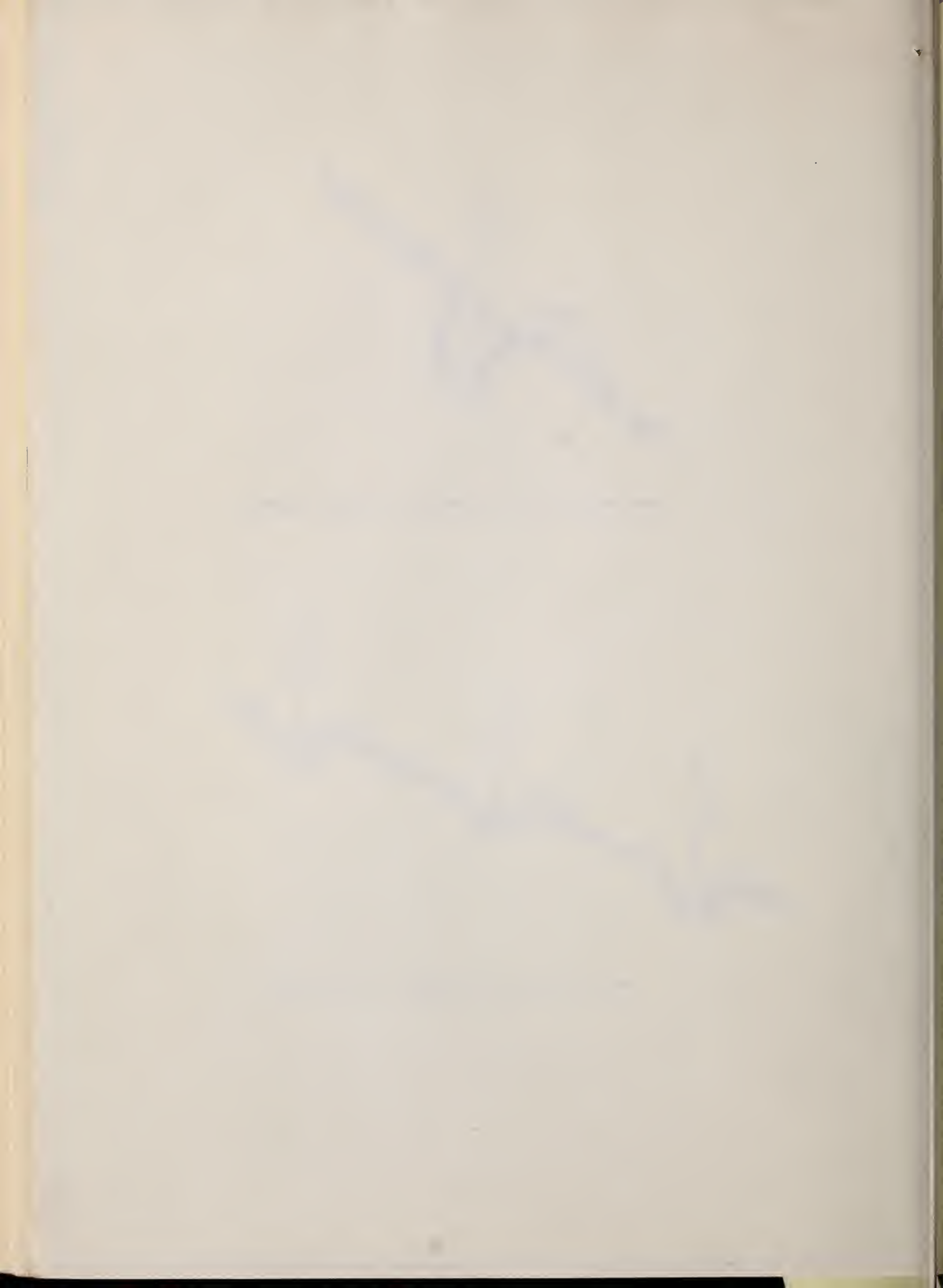




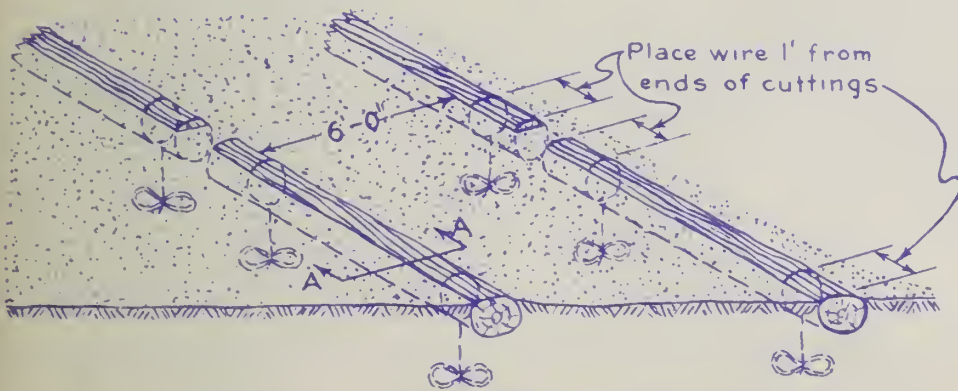
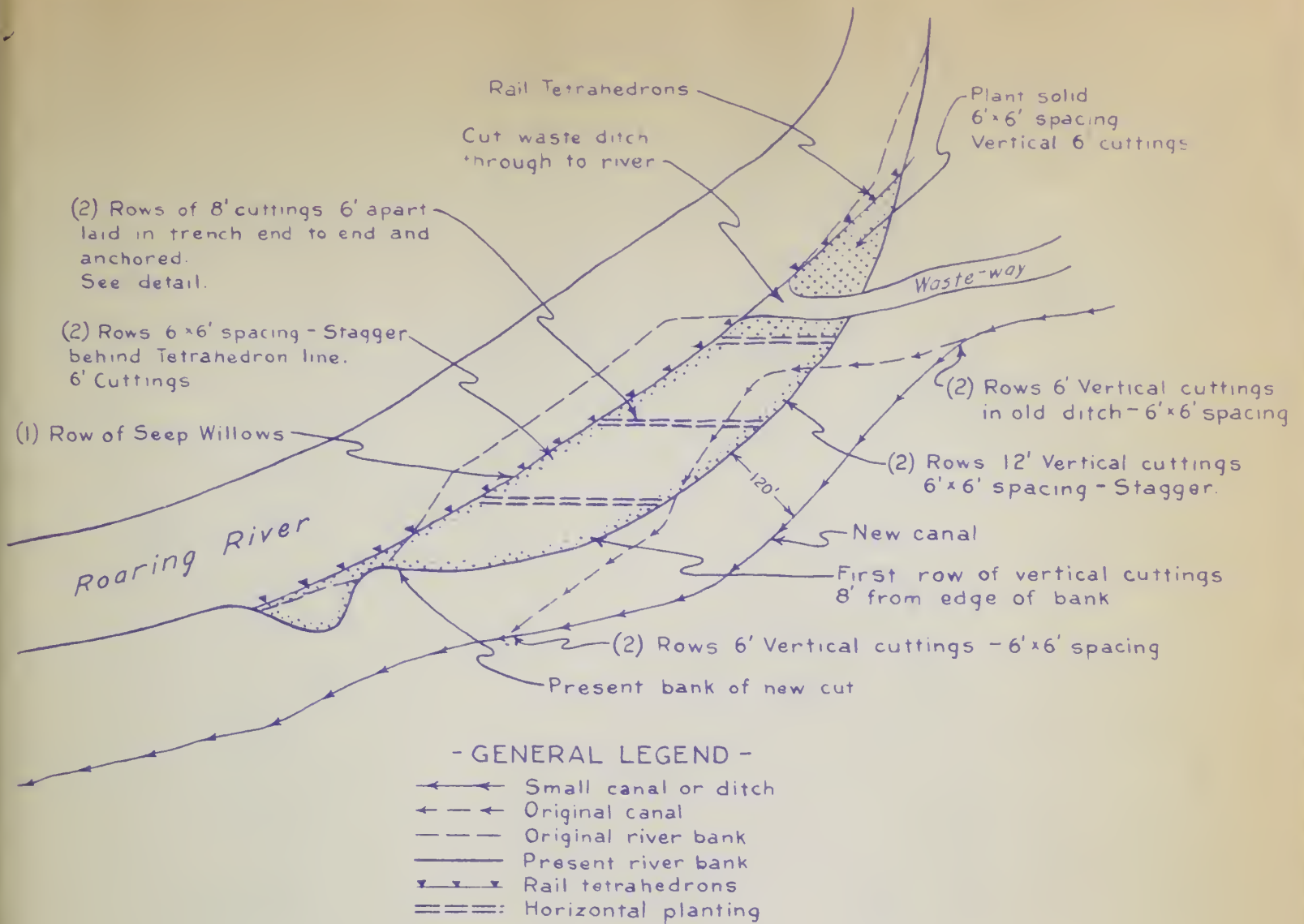
ONE METHOD OF PLANTING ON GULLY BANK



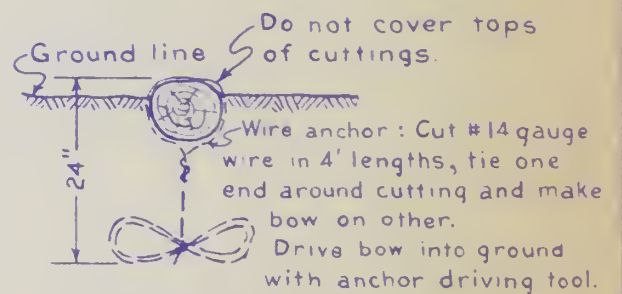
POSITION OF A TREE IN A FURROW



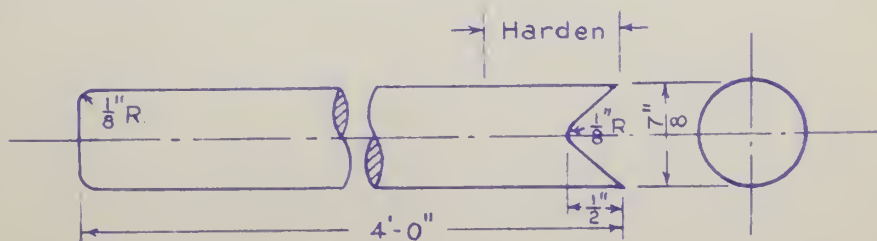




HORIZONTAL PLANTING & ANCHOR DETAIL



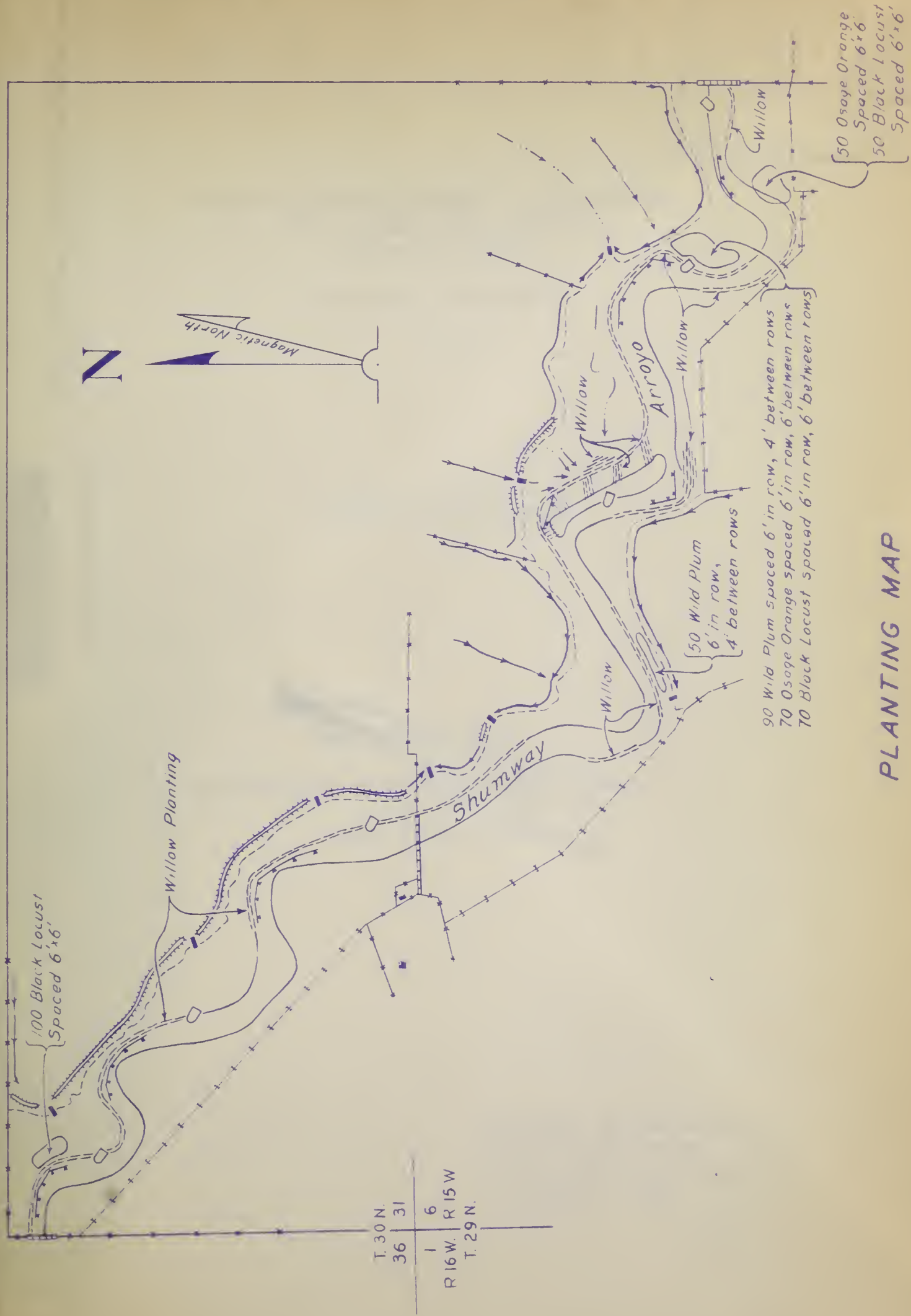
SECTION A-A



ANCHOR DRIVING TOOL  
Mat. - 7/8" Drill Steel  
Scale 6" = 1'-0"

## PLANTING DETAILS





PLANTING MAP

Conservation Service  
U. S. Department of Agriculture  
Washington, D. C.